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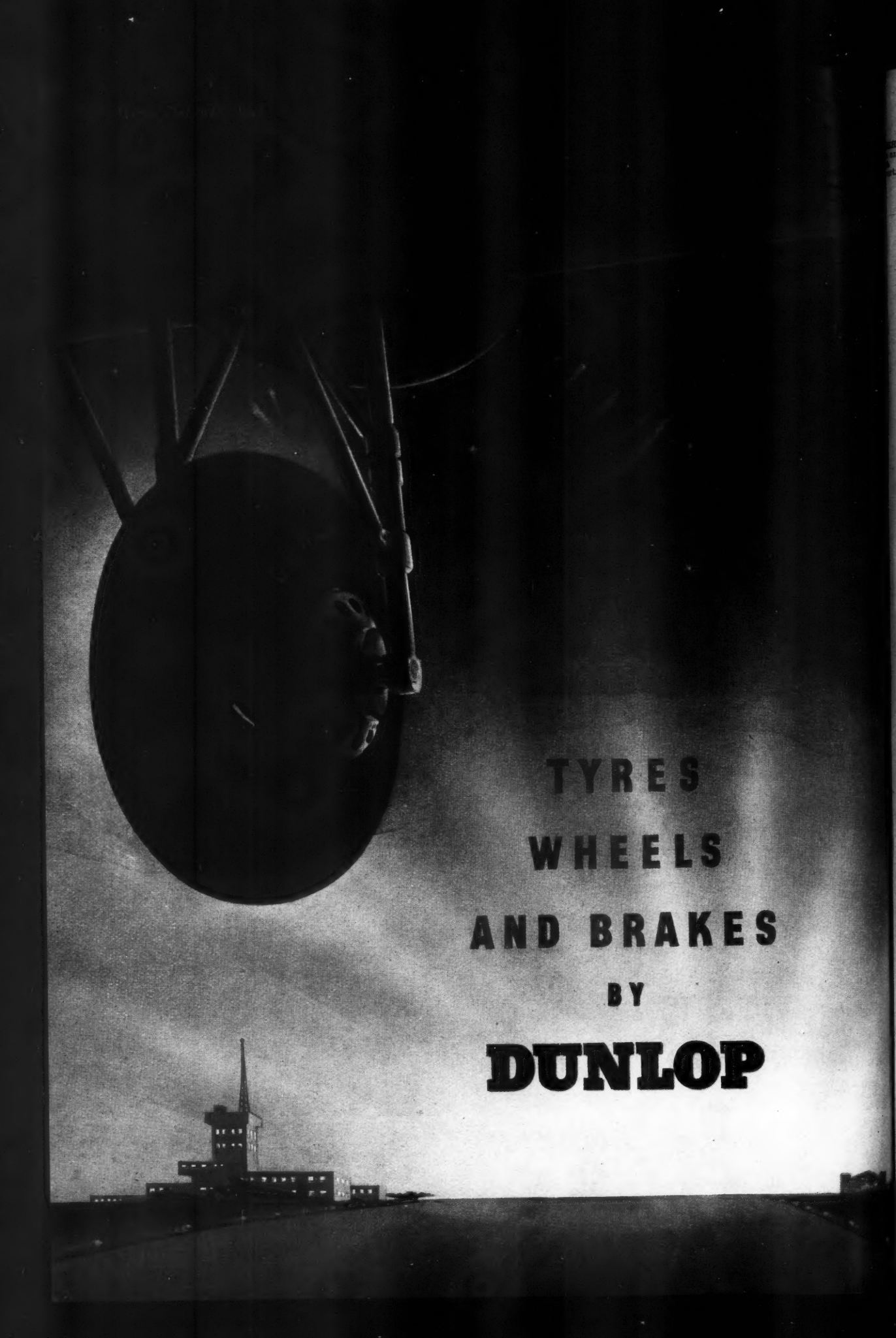
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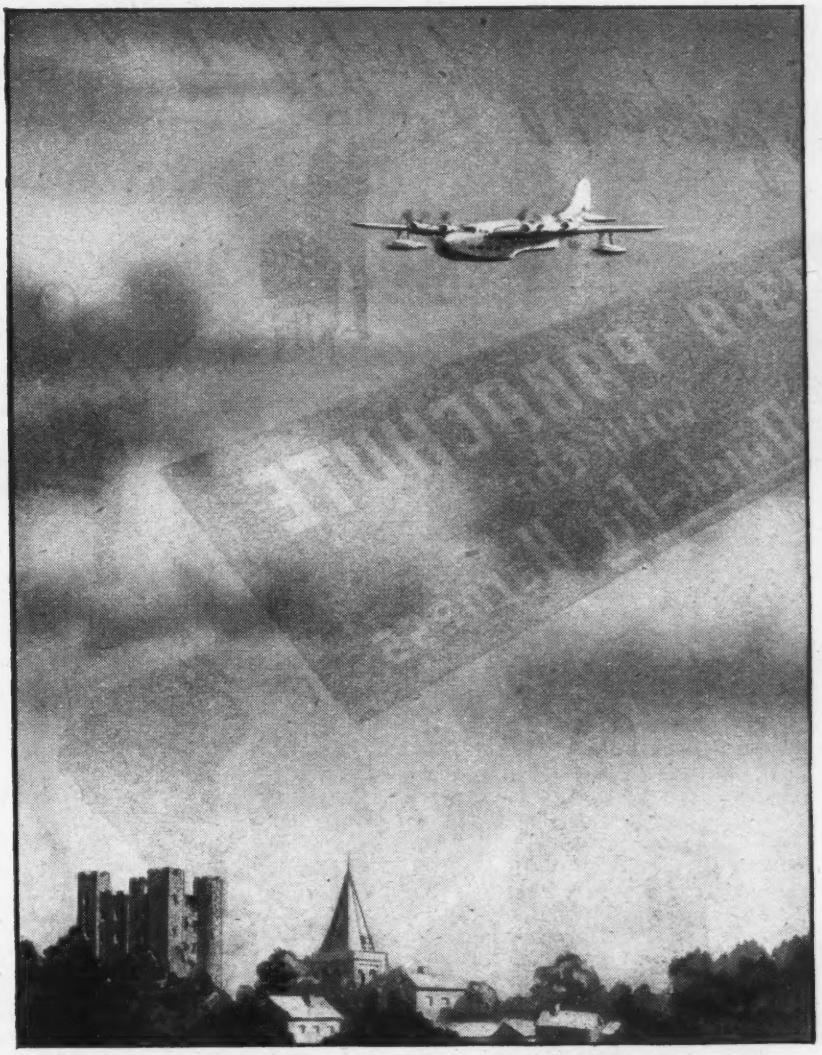

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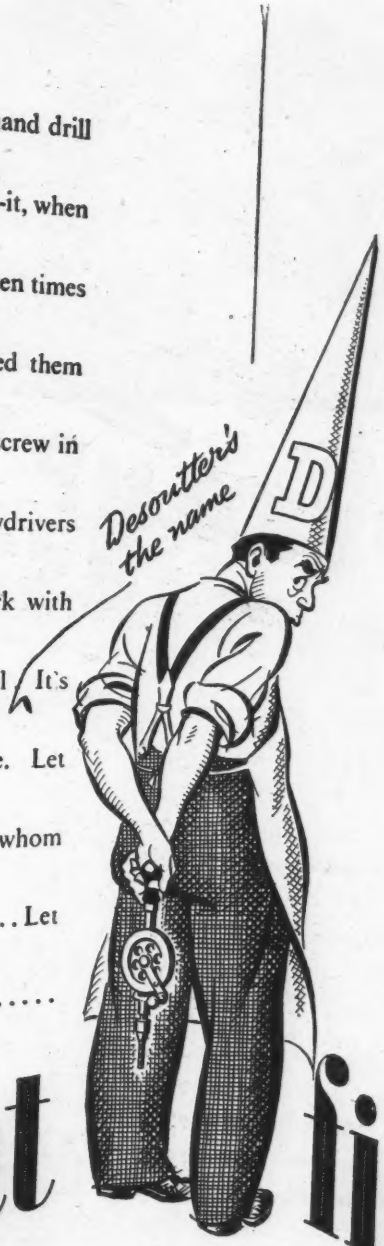


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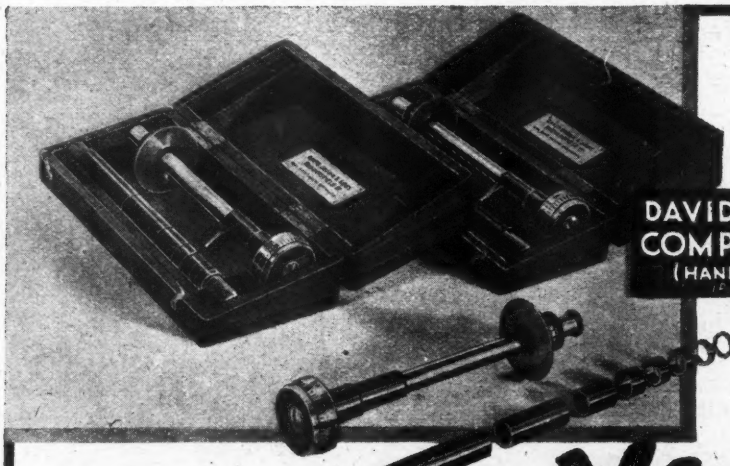


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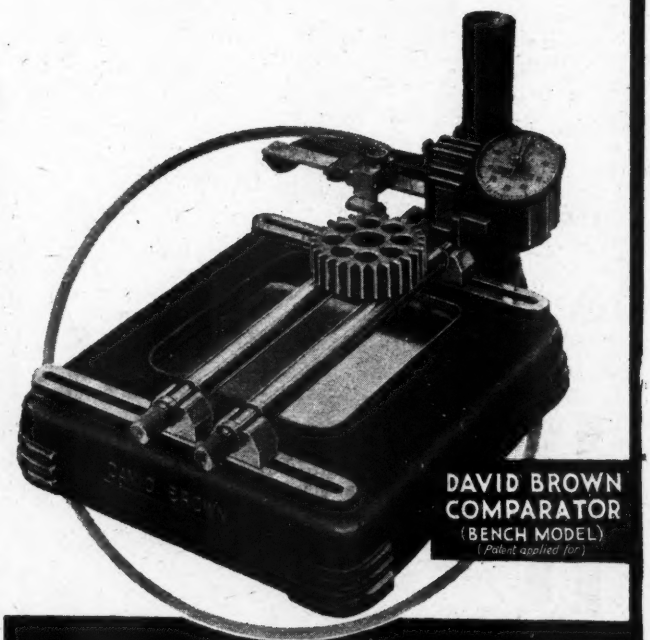


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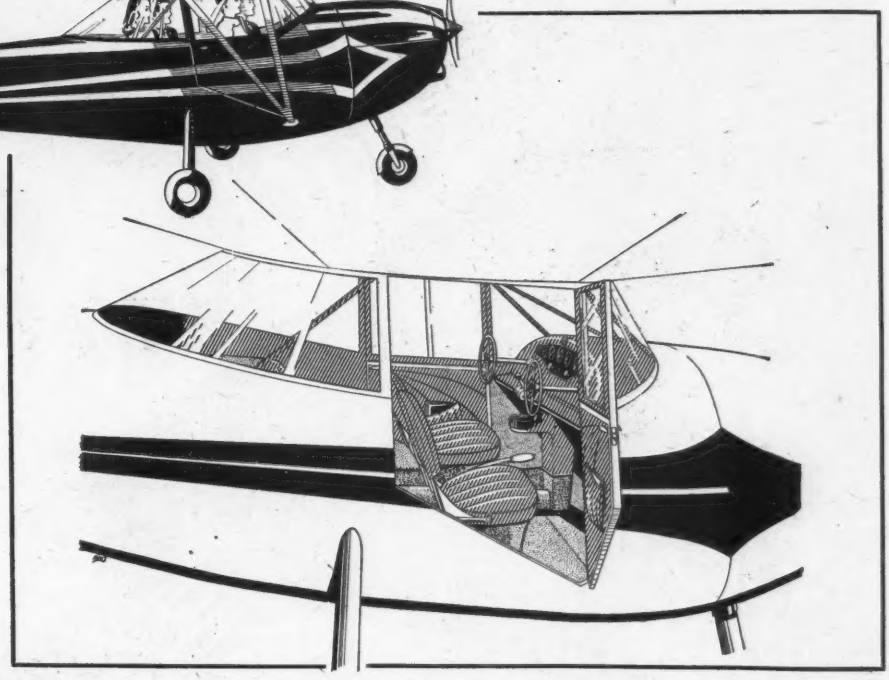

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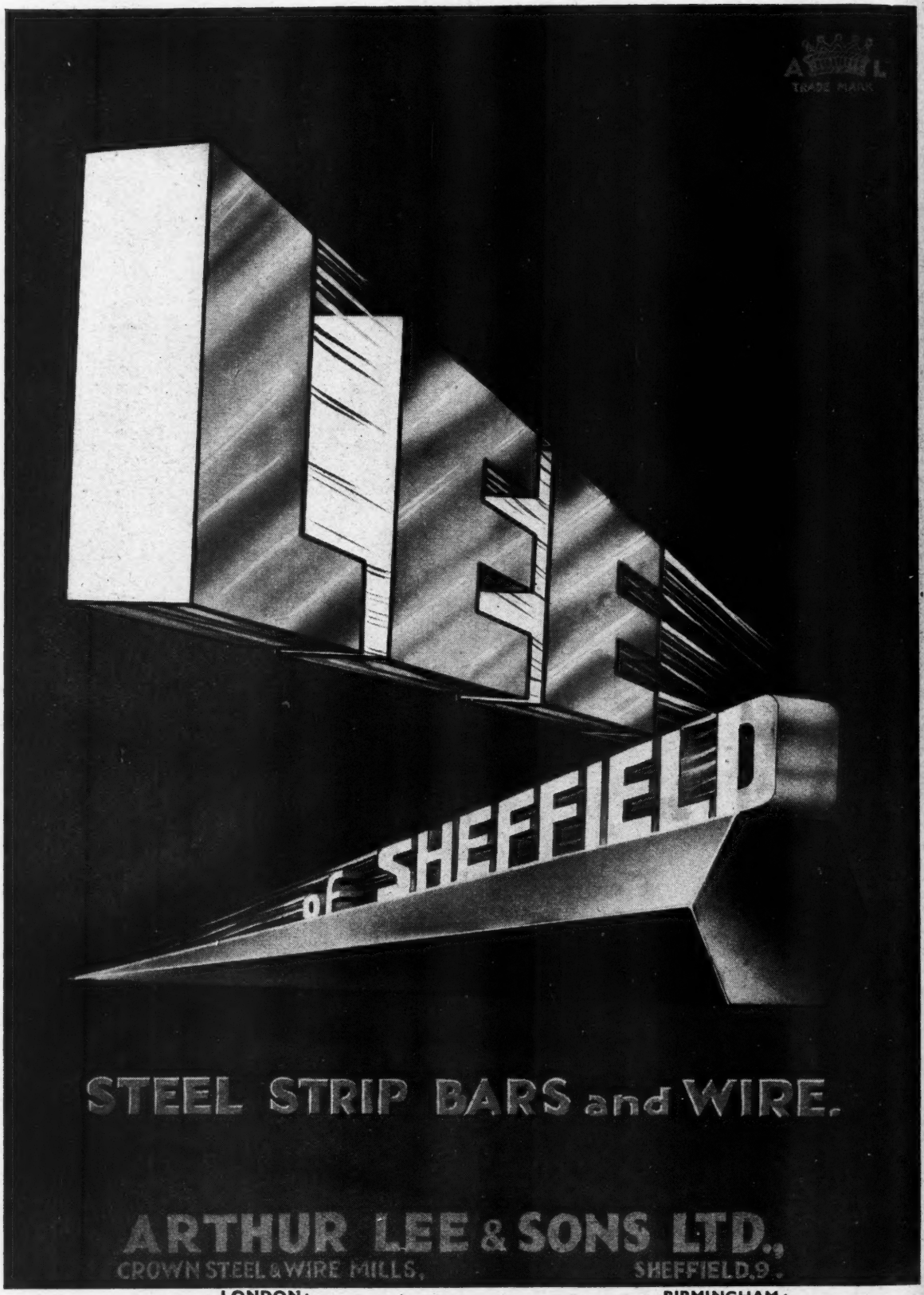


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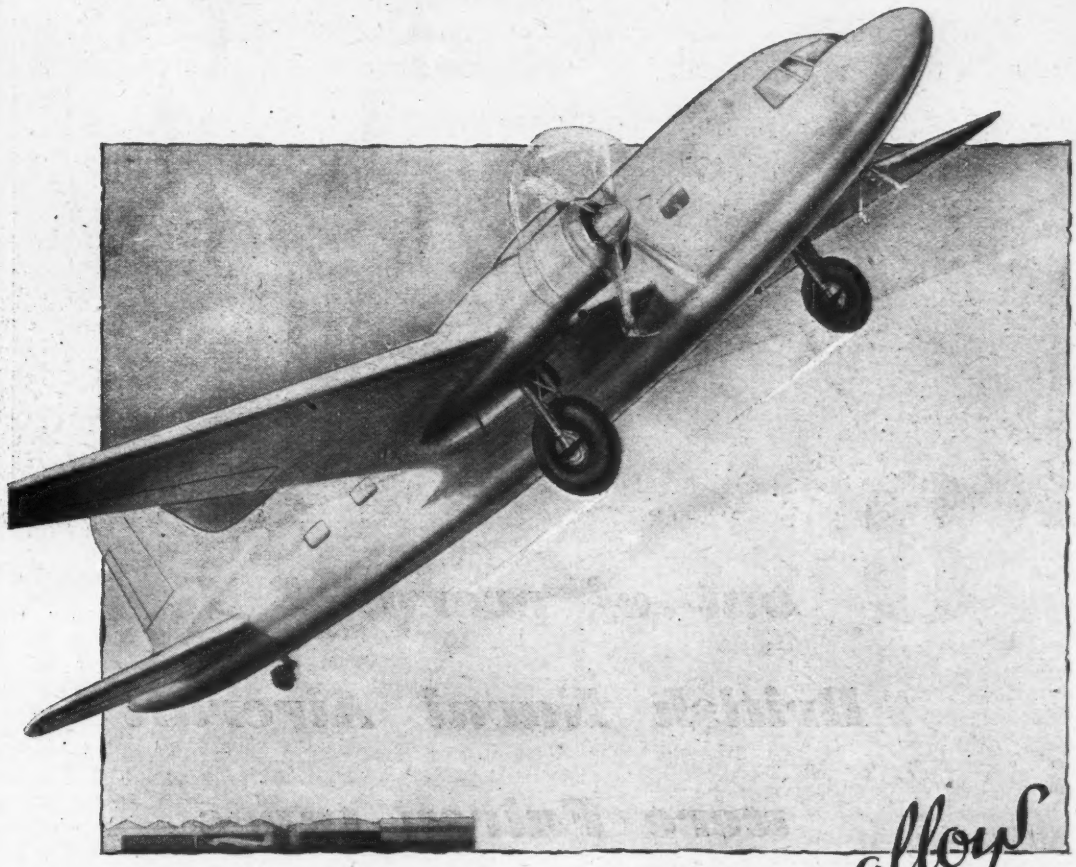

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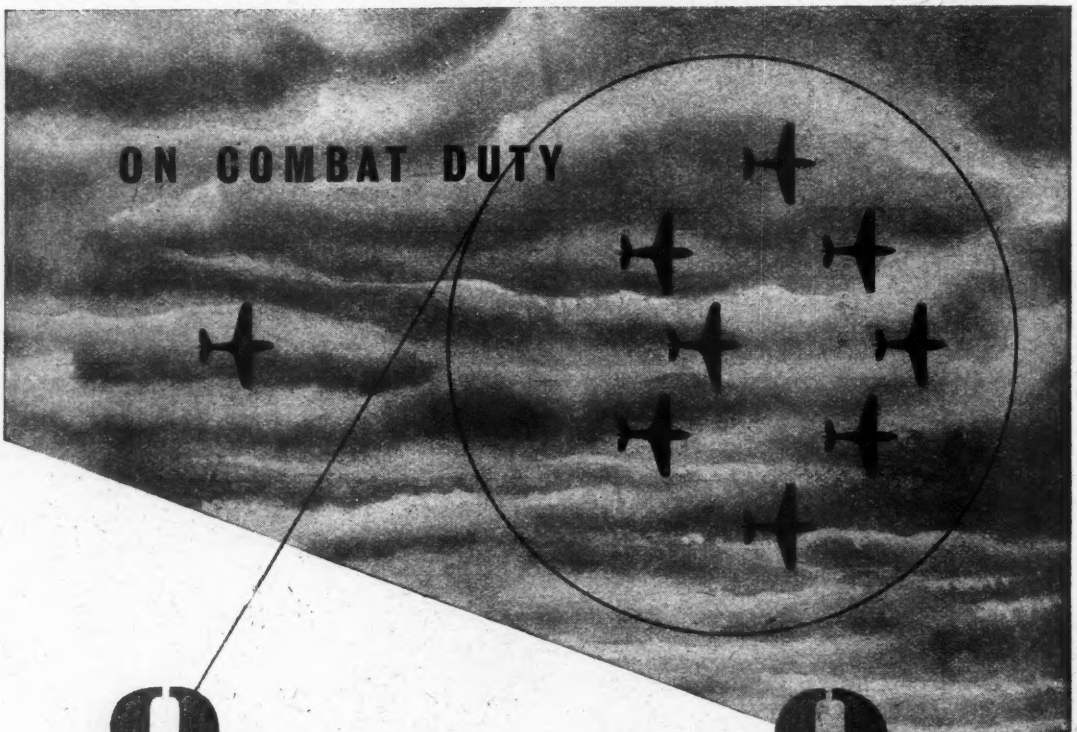


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# The Outlook

## Gas Turbine Assessment

OPTIMISM was the keynote at the R.Ae.S. all-day debate on gas turbines. In fact, it may be said (without offence, we hope) that the audience of this august society was for once more like a lot of boys delighted with a new toy. The papers read were informative and confident and the discussion more light-hearted than is usually the case.

That, we think, is a very good sign. Enthusiasm was beginning to wane before the advent of the gas turbine. We seemed to be approaching the limits in performance; airframe design had settled down to the point of becoming stereotyped; piston engines and variable-pitch airscrews seemed to have been developed just about as far as was possible. The gas turbine has changed all that. Not only are there a wide variety of turbines possible, but we have not even begun to discover the best aircraft shapes for them.

We are on the threshold of great discoveries, but we are also faced with a number of intricate problems. We are in fact, at the stage which Mr. W. G. Carter so aptly termed "uneasy experiment." Unbounded enthusiasm is needed to tackle the immediate future, and it was cheering to find it in such full measure at last week's meeting. The council of the Royal Aeronautical Society is to be congratulated on its choice of speakers. Each dealt with a particular subject, and between them they covered the field fairly well so that it became possible to form a picture of at least the immediate trends. The wider horizons which will open out when we get through the "compressibility wall" are still shrouded in the mists of ignorance.

The conclusion to be drawn from the papers is that the turbine designers are in a position to give the aircraft designers all the thrust they can use; that in commercial aviation the turbine-driven airscrew can give greatly increased pay loads at much higher cruising speeds than those to which we have been accustomed; and that in military aircraft—fighters in particular—the enormous thrusts available from plain jets can be used immediately to give phenomenal rates of climb, even if compressibility troubles should prevent us for the present from applying them to the raising of maximum speeds. The road to installation of maximum thrust was indicated by Mr. Carter: two power units in the wings and one in the fuselage.

In civil aviation it would appear that the development may be in the direction of turbine-driven airscrews. Mr. Clarkson showed several four-engined layouts of this nature, but Mr. Stafford pointed out that the offset thrust if one unit stopped might be more than any reasonable fin and rudder area could take care of, and that coupled units driving contra-rotating airscrews might form a better solution. The gears would add weight and complication, but the arrangement should result in very clean large twin-screw types.

## Debatable Details

WHILE there was unanimity on the brilliant future which the new prime-mover promises, there was naturally some divergence of opinion when it came to details. That was inevitable with so many possible solutions offering themselves. For example, as Air Commodore Banks said, it is no use arguing as to whether the centrifugal or the axial compressor is the best. We shall not know until both have been developed and thoroughly tried out. This the Ministry intends to do.

The compound engine advocated in Dr. Ricardo's paper came in for less attention than, we suggest, it merited. It is true, of course, that its advantage of low fuel consumption is confined mainly to long ranges, but it would be rash to argue that these will not be needed in the future. And the weight of the compound unit may not be by any means prohibitive. It is power-plant weight plus fuel weight that matters on anything

but short stages, and there are operational advantages, on many routes, in reducing intermediate landings to a minimum.

An interesting point brought out in the discussion was that at one R.A.F. station equipped with jet fighters, the number of engine fitters had been reduced to half. The simplicity of the plain jet engine has reduced maintenance to that extent.

## The Air Estimates

ANY critical study of the Air Estimates which were introduced last week is impossible for, as the Under-Secretary of State for Air said, they are transitional, and, in any case, no detail figures are at present available other than the totals for the various votes. Even these totals are apt to be misleading. For example, of the figure for pay, etc., amounting to over £176,000,000, no less than £80,000,000 represents the cost of release leave pay, war gratuities and post-war credits.

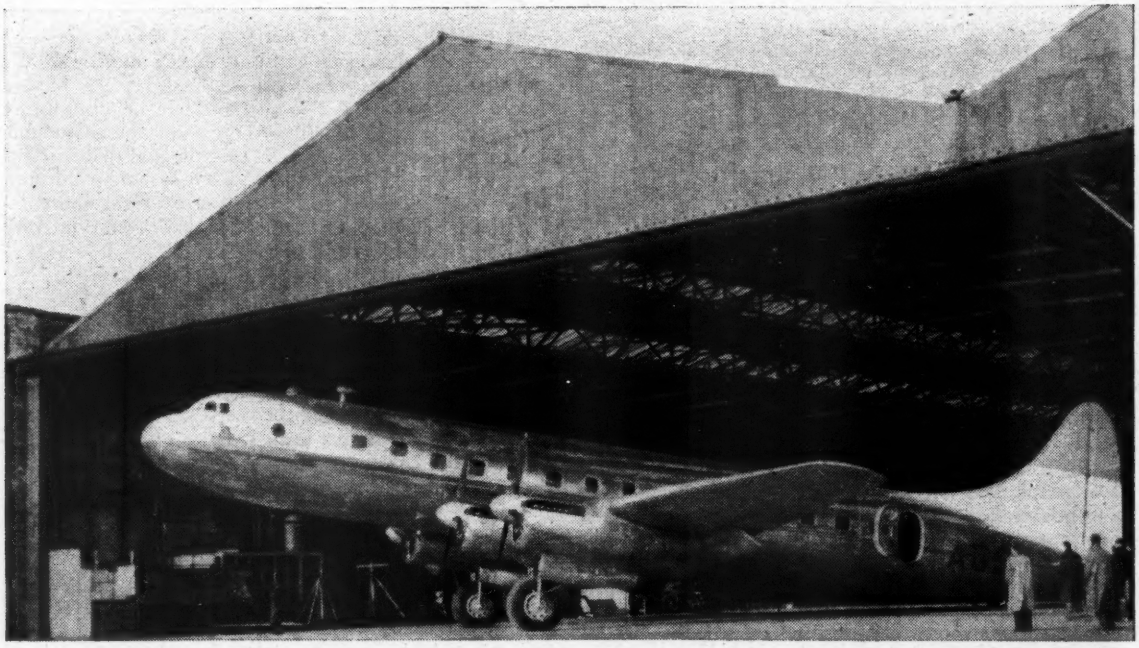
In fact, the most interesting figures, namely, those for aviation research and development, and for new aircraft and supplies generally, are not now included in the Air Estimates at all. Instead they are to be contained in the Vote for the Ministry of Supply. The centralization of all aviation research and development in the Ministry of Supply has obvious good points, for effort is co-ordinated and concentrated under such a scheme, and all progress made should be reflected in a common advancement of the entire field of aviation in this country. However, £28,000,000 for this purpose is not nearly so large as it sounds when one considers the cost of development of experimental aircraft and engines.

Unfortunately, too, there is another side to the question. The control by an outside Department of all research and supply is liable to hamper liaison between the Service and the aircraft industry, and this may well prove disastrous in course of time. As it is, Ministries have a marked aptitude for keeping their suppliers in the dark about future developments, and the gloom may well become Stygian when all consultation has to be conducted through a third party during the slower tempo of peace-time. We hope that the continued presence of a member of the Air Council as Controller of Aircraft Supplies will reduce the risk of such a calamity.

One other figure which is worthy of comment, at this stage, is the rather paltry sum for Reserve and Auxiliary Forces. We join wholeheartedly with Group Capt. Ward in hoping that the sum quoted so far in the Estimates for this purpose is not a reflection of the importance attached by the Government to these forces, particularly when compared with the amount voted for the Air Ministry itself.

CONTENTS


| | |
|---|---|
| The Outlook | 279 |
| The Gas Turbine in Commercial Aviation | 281 |
| Jet Propulsion and Military Aircraft | 284 |
| Here and There | 286 |
| Britain's Test Pilots | 288 |
| R.Ae.S. Debates the Gas Turbine | 291 |
| Westland Lysander | a |
| Civil Aviation | 293 |
| American Newsletter | 295 |
| The Air Estimates | 297 |
| England—New Zealand Records | 300 |
| Correspondence | 301 |
| Service Aviation | 302 |
| Industry | 304 |

**LATEST CIVILIAN TUDOR II COMES OUT:** On March 11th, as recorded in last week's issue, the prototype Avro Tudor II made its first test flight. Here is this newest of British "interim" civil types on its way out of the experimental shop. Its passenger capacity increase, in comparison with the Atlantic Tudor I, is fairly obvious; it can, in fact, carry as many as sixty passengers over a range of 1,800 miles at 230 m.p.h. and 20,000ft. The power units of the prototype are Merlin 102 A's.

# The Gas Turbine in Commercial Aviation

## *Increased Pay Load at Much Higher Speeds Foreshadowed*

By R. M. CLARKSON, F.R.Ae.S.

FOUR very interesting papers were read before the Royal Aeronautical Society during its all-day meeting in the lecture hall of the Institution of Civil Engineers in London on Wednesday of last week. Dr. H. R. Ricardo dealt with the power plant compounded of a piston engine and a gas turbine, the great feature of which is its amazing fuel economy. His paper was summarized in last week's issue. This week we publish summaries of the other three papers: that by Dr. S. G. Hooker on the application of the gas turbine to aircraft propulsion (see pp. 291-292 of this issue); Mr. R. M. Clarkson on the application of the gas turbine in its forms to the field of commercial aviation, and Mr. W. G. Carter on its application to military aviation.

Mr. Clarkson, a summary of whose paper follows, confined himself to discussing the effects upon the speed and economy of commercial aviation of the two simplest and immediate variants of the gas turbine, the simple jet-producing turbine and the simple propeller-driving turbine. Table I compares several different types of engines and gives an indication of what may be expected from turbine engines compared with piston engines. Mr. Clarkson explained that engine No. 1 is in being, No. 3 nearly so, and Nos. 4 and 6 might be available to the operator within the period of five years to which he had limited his paper. The table gave general trends rather than precise engine capabilities and should be regarded as stages in a development programme.

On the subject of reliability, serviceability and maintenance Mr. Clarkson said ultimately the gas turbine would be superior to the piston engine, owing to its simplicity, but the operator would want to know what was meant by "ultimately." He wanted these qualities delivered to him with the engine, and Mr. Clarkson thought that here there was a problem to be tackled energetically and imaginatively.

### Fractional Cruising Power

With piston engines it was customary to use maximum power output for reliable operation of about 50 per cent of the take-off power corresponding to 80 per cent of take-off r.p.m. For the gas turbine the comparable figure appeared to be 90 per cent of maximum r.p.m. and 80 per cent of maximum power at that height. From the curves in Fig. 1 it is seen that the two curves are roughly coincident at 25,000ft, but that at lower altitudes much greater fractional power outputs can be taken from the turbine, if required, for equal life.

First cost was not one of the most important factors, but this should be relatively low, due to the inherent simplicity.

The noise of a gas turbine was rather irritating, but he did not think it would be unduly troublesome to passengers. With a simple jet engine, low-frequency vibration was non-existent, but there was a very high-frequency vibration which might possibly become troublesome. On the whole, the vibration characteristics could scarcely be worse and might be better than those of the piston engine.

Turning to the subject of fuel, Mr. Clarkson said that besides providing greater safety from fire hazard, paraffin ought to be cheaper than petrol. He took, for the purpose of the paper, petrol at 2s per gallon and paraffin at 1s 4d per gallon.

The next step was to examine one or two representative types of aircraft when designed: (a) for piston engines and (b) for gas turbines. Taking first a medium-size twin-engined feeder-line type, Mr. Clarkson started with the following specification: Pay load with 500 miles still-air range at 5,000ft—3,000lb; seating 12 passengers and a crew of two. Satisfactory compliance with A.R.B. safety requirements on a warm day.

The following engine characteristics were assumed:—

| | Piston engine | Propeller-driving turbine |
|---|---|---|
| Installed wt per equivalent t.o. h.p. ... | 2.4 lb/h.p. | 1.5 lb/h.p. |
| Cruising specific fuel consumption ... | 0.49 lb/b.h.p./hr | 0.52 lb/equivalent b.h.p./hr |
| Cruising condition ... ... ... ... | 50 per cent of take-off b.h.p. | 90 per cent of take-off r.p.m. (72 per cent t.o. power) |

On these assumptions the aircraft arrived at will have the following characteristics:—

| | Piston engine | Propeller-driving Turbine |
|---|---|---|
| All-up weight ... ... ... ... | 13,500 lb | 10,600 lb |
| Installed power (take-off) ... ... | 2 × 700 b.h.p. | 2 × 550 equivalent b.h.p. |
| Cross wing area ... ... ... | 500 sq. ft | 390 sq. ft |
| Overall span ... ... ... ... | 69ft | 61ft |
| Wing loading ... ... ... ... | 27 lb/sq. ft | 27 lb/sq. ft |
| Fuel for 500 miles ... ... ... | 141 gallons | 131 gallons |
| Cruising speed ... ... ... ... | 185 m.p.h. | 215 m.p.h. |
| Pay load ... ... ... ... ... | 3,000 lb | 3,000 lb |
| Ton-miles of pay load per gallon of fuel | 5.4 | 5.7 |
| Ton-miles of pay load per hour ... | 248 | 288 |
| First cost of complete aircraft ... | £19,000 | £15,500 |
| Direct operating cost per ton-mile of pay load ... ... ... ... | 13.9d. | 9.4d |

Direct operating cost includes the following items:—

| | |
|---|---|
| Fuel and oil ... ... ... ... | Petrol 2/- per gallon + 6 per cent for oil. Paraffin 1/4 per gallon + 1 per cent for oil. |
| Maintenance: | |
| Airframe ... ... ... ... | £1 10s. per aircraft flying hour per 10,000 lb of airframe weight. |
| Engine ... ... ... ... | £1 per aircraft flying hour per 1,000 take-off b.h.p. (for piston and turbine). |
| Crew ... ... ... ... ... | £1,600 per annum and 850 crew flying hours per annum. |
| Depreciation: | |
| Airframe ... ... ... ... | 5 years' life with 25 per cent residual value. |
| Engine ... ... ... ... | 2½ years' life with 25 per cent residual value |
| Insurance ... ... ... ... | 8 per cent of the first cost. |
| Interest on investment ... ... | 5 per cent of the first cost. |

Passenger service, overheads, etc., are not included in direct operating cost.

The first cost of the airframe is taken at £2 10s per lb of airframe weight, and of the engine £4 per take-off h.p. Spares 20 per cent of first cost of complete aircraft. Utilization 2,000 hours per annum.

To carry the same pay load as the piston-engined aircraft, the turbine aircraft is 22 per cent smaller, 18 per cent cheaper, 22 per cent lighter, 16 per cent faster,

TABLE I.

| Type of Power Unit | Installed Weight. | *Specific Consumption. | Drag—lb at 100 ft/sec. |
|---|---|---|---|
| 1. Piston — air-cooled radial type. | 2.0 lb/take-off b.h.p. | 0.46 lb/cruising b.h.p./hr. | 38 lb per 3,000 take-off b.h.p. |
| 2. Piston—liquid-cooled. | 2.1 lb/cruising b.h.p. | 0.53 lb/cruising b.h.p./hr. | 22 lb per 3,000 take-off b.h.p. |
| 3. Propeller-driving centrifugal gas turbine. | 1.2 lb/equivalent take-off b.h.p. | 0.5 lb/equivalent cruising b.h.p./hr. | 13 lb per 3,000 equivalent take-off b.h.p. |
| 4. Propeller-driving axial gas turbine — advanced type. | 0.75 lb/equivalent take-off b.h.p. | 0.45 lb/equivalent cruising b.h.p./hr. | 9 lb. per 3,000 equivalent take-off b.h.p. |
| 5. Simple jet — centrifugal. | 0.5 lb/lb. static thrust. | †1.05 lb/lb static thrust. | 5 lb per 5,000 lb static thrust. |
| 6. Simple jet — axial — advanced type. | 0.35 lb/lb static thrust. | ‡0.90 lb/lb static thrust. | 0 lb. per 5,000 lb static thrust. |

* At 300 m.p.h. unless otherwise stated. ‡ Gives 0.56 lb/equivalent b.h.p. at 500 m.p.h.
† Gives 0.65 lb/equivalent b.h.p. at 500 m.ph.

# THE GAS TURBINE IN COMMERCIAL AVIATION

requires 21 per cent less installed power, is 32 per cent cheaper to run; and can perform 16 per cent more work in a year. It is the substantial saving in power unit weight per horse power possible with the turbine which is the chief cause of these improvements.

In the private-owner class of aircraft, with engines of some 150 h.p., Mr. Clarkson did not look for any significant improvement, but the practical advantages would be available to the private owner and would amply justify the introduction of the new prime mover. Ruggedness, low first cost and reliability would result in an engine of not very competitive economy and the huge gear reduction would tend to make the engine heavier and bulkier than might be expected.

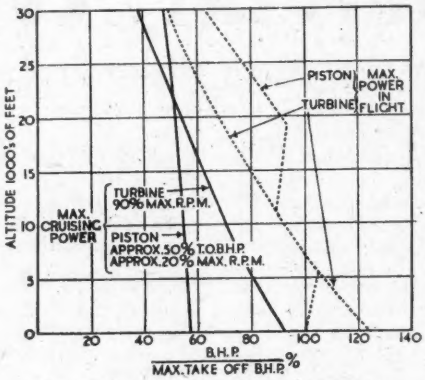



**Fig. 1. Approximate picture of relative cruising-power outputs for equal take-off power of piston and turbine engines.**

Skipping several intermediate stages, Mr. Clarkson turned his attention to the long-range type of Empire airliners. He stipulated non-stop stages of 2,200 miles (against a 50 m.p.h. headwind plus a 450 miles' allowance for reaching an alternative airfield), entailing a still-air range of 3,000 miles. For the purpose of investigation he stipulated the following design requirements: Cruising altitude not less than 25,000ft; take-off under tropical conditions not more than 1,500 yards to clear 50ft; maximum wing loading for take-off 70lb/sq ft; maximum wing loading for landing 55lb/sq ft. A range of cruising speeds from approximately 300 to 500 m.p.h. was covered, and engines 1, 2, 3 and 4 of Table I separately investigated.

### Empire Airliners

For the 300 m.p.h. case he took an aircraft of 100,000lb all-up weight with 150ft span and 1,800 sq ft of wing area. In passing to the higher cruising speeds, more power was installed, and all-up weights allowed to rise. Structure weights were suitably adjusted, and fuselage dimensions and passenger accommodation suited to the resulting pay loads. At the high-speed end reduction in span was found to be desirable, the wing area remaining unchanged. All the aircraft are cruised at 15 per cent above the speed for maximum L/D at 50 per cent of take-off power for piston engines and 90 per cent maximum revolutions (45 per cent of take-off power) for turbines. Fig. 3 gives a rough idea of the size and weight of some of the power units installed at different cruising speeds.

Fig. 4 shows pay load attainable in aircraft of approximately constant size when designed for different cruising speeds and powered with different types of engine. If an overall transition at 60 per cent of the chord could be achieved at no cost in weight, point "A" would move to point "T."

The aircraft represented at point "B" has four engines of 11,500 h.p. each. The power loading of the whole aircraft is under 3lb/h.p.; aircrew efficiency has fallen to 70 per cent and will probably fall rapidly with increasing speed. Furthermore, compressibility drag rise is beginning to set in, necessitating the incorporation of sweepback. It seems unlikely that the engines for this aircraft could be available within five years.

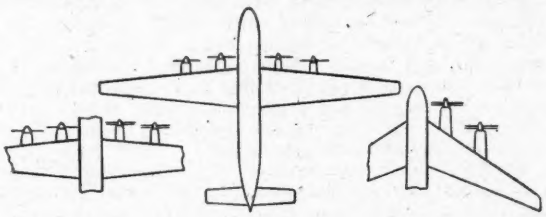


**Fig. 3. Long-range Empire airliners. All-up weight 100,000 lb, 150ft span, 1,800 sq. ft. wing area. The full plan view shows, on the port wing, radial air-cooled piston engines totalling 4 x 2,250=9,000 h.p. Power-unit weight, 17.5 per cent. of a.u.w. Cruising speed, 280 m.p.h. On the starboard wing, axial gas turbines driving airscrews, totalling 4 x 2,550 = 10,200 h.p. Power unit weight, 7.5 per cent. of a.u.w. Cruising speed, 300 m.p.h. The corresponding figures for the part-plan view on the left are: Port wing liquid-cooled piston engines totalling 16,000 h.p. Power unit weight, 25.5 per cent of a.u.w. Cruising speed, 370 m.p.h. Starboard wing axial gas turbines driving airscrews, total 25,600 h.p. Power unit weight, 15.5 per cent of a.u.w. Cruising speed, 425 m.p.h.**

**In the view on the right, sweepback has been used, and the power units are gas turbines driving airscrews. Total power, 4 x 11,400= 45,600 h.p. Power unit weight, 26.5 per cent of a.u.w. Cruising speed 515 m.p.h.**

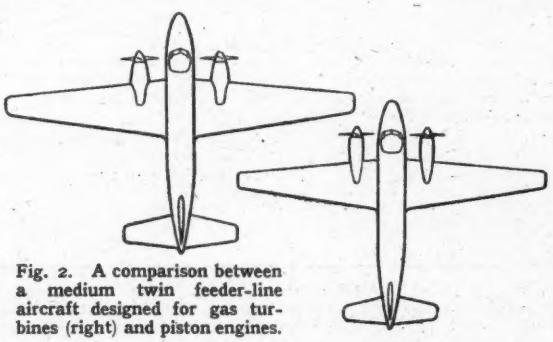


**Fig. 2. A comparison between a medium twin feeder-line aircraft designed for gas turbines (right) and piston engines.**

| | Turbo-screw. | Piston |
|---|---|---|
| All-up weight... ... ... ... ... ... | 10,600 lb. | 13,500 lb. |
| Installed power (t.o. ... ... ... ... ... | 2 x 550 b.h.p. | 2 x 700 b.h.p. |
| Gross wing area ... ... ... ... ... ... | 390 sq. ft. | 500 sq. ft. |
| Overall span ... ... ... ... ... ... | 61ft. | 69ft. |
| Wing loading ... ... ... ... ... ... | 27 lb/sq. ft. | 27 lb/sq. ft. |
| Fuel for 500 miles ... ... ... ... ... | 131 gals. | 141 gals. |
| Cruising speed ... ... ... ... ... ... | 215 m.p.h. | 185 m.p.h. |
| Pay load ... ... ... ... ... ... ... | 3,000 lb. | 3,000 lb. |
| Ton-miles of pay load per gallon of fuel ... ... | 5.7 | 5.4 |
| Ton-miles of pay load per hour ... ... ... | 288 | 248 |
| First cost of complete aircraft ... ... ... | £15,500 | £19,000 |
| Direct operating cost per ton-mile of pay load ... | 9.4d. | 13.9d. |

Of the commercial type of aircraft with simple jet engines Mr. Clarkson said that its high-speed possibilities made it most suitable for long-range work, but it was technically least suited to this duty on account of poor take-off thrust and high consumption. Assisted take-off would be required, and a certain austerity in passenger accommodation. Some acute problems might be encountered owing to the high Mach number, but if the difficulties could be overcome, cruising speeds could be pushed beyond that of aircraft "B" in Fig. 5, as shown by the curves marked "J centrifugal" and "J axial".

Fig. 5 shows direct operating costs per ton-mile of pay load, plotted against effective cruising speed. This is the cruising speed made good over a 2,200 miles' run in still air after making allowance for climb and descent, and a quarter of an hour for stand-off, taxying, etc.

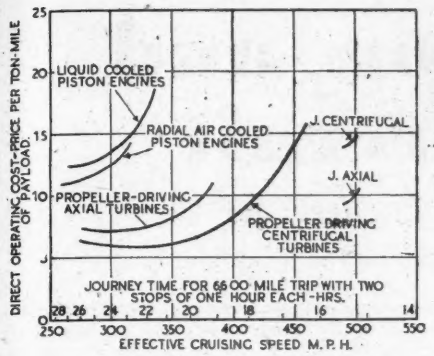

DIRECT OPERATING COST-PRICE PER TON-MILE OF PAYLOAD
LIQUID COOLED PISTON ENGINES
RADIAL AIR COOLED PISTON ENGINES
J. CENTRIFUGAL
J. AXIAL
PROPELLER-DRIVING AXIAL TURBINES
PROPELLER DRIVING CENTRIFUGAL TURBINES
JOURNEY TIME FOR 6600 MILE TRIP WITH TWO STOPS OF ONE HOUR EACH - HRS.
28 26 24 22 20 18 16 14
EFFECTIVE CRUISING SPEED M.P.H.

**Fig. 5. Direct operating cost per ton-mile of pay load plotted against effective cruising speed.**

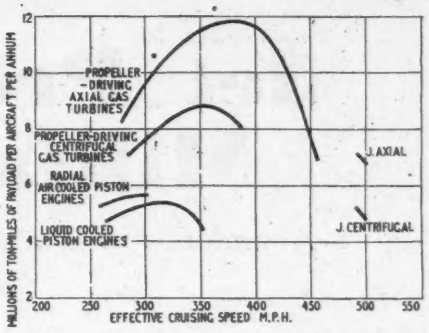

MILLIONS OF TON-MILES OF PAYLOAD PER AIRCRAFT PER ANNUM
PROPELLER-DRIVING AXIAL GAS TURBINES
PROPELLER-DRIVING CENTRIFUGAL GAS TURBINES
RADIAL AIR COOLED PISTON ENGINES
LIQUID COOLED PISTON ENGINES
J. AXIAL
J. CENTRIFUGAL
EFFECTIVE CRUISING SPEED M.P.H.

**Fig. 6. Earning capacity, or the ton-miles of pay load that can be shifted per annum per aircraft.**

Along the bottom of the graph of Fig. 5 has been put a scale of total time for a journey of 6,600 miles in three hops, allowing one hour on the ground per stop. This is about the distance to South Africa or South America, and half the distance to Australia. This scale has been included because it is really time saved rather than cruising speed for which the passenger is paying.

In connection with Fig. 6, operating costs have been calculated as in the feeder-line type, but maintenance cost per unit of airframe weight and engine power has been increased by 33 per cent due to greater complexity. Crew cost has been raised appropriately; insurance raised to 12 per cent; first cost of airframe per unit weight increased by 20 per cent, and spares allowance increased to 30 per cent. A utilization of 3,000 hours per annum has been assumed.

The characteristics of trans-ocean and long-range aircraft are plotted in Fig. 7. For operating from trans-ocean airports, wing loadings can be allowed to go up to 80 lb/sq. ft. and take-offs to about 2,000 yards to clear 50ft. Fig. 7 shows curves of pay load against still-air range for several aircraft of fixed weight and size. The fuselage capacities have been adjusted to their pay loads along the curves, so that any point on a curve is an aircraft designed to carry that particular pay load over that particular range.

Mr. Clarkson said he could not see that still-air ranges of much more than 5,000 miles were of much practical value, but it seemed quite possible to do 8,000 miles with

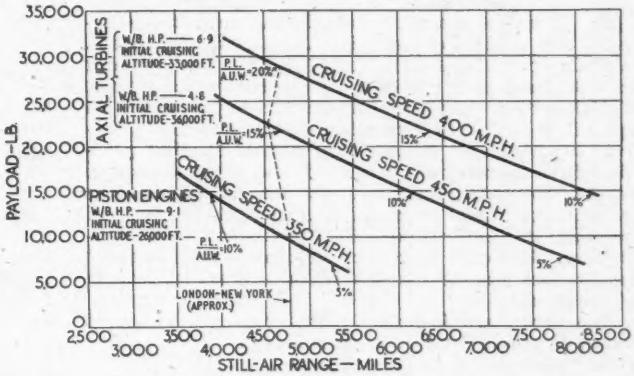



**Fig. 7. Curves of pay load against still-air range for several long-range aircraft of fixed weight and size.**

reasonable economy, as indicated by the figures of payload /a.u.w. per cent marked along the curves. If the 5,000 miles was the practical commercial maximum the straightforward turbine-airscrew combination could make a very good showing, and it might be asked whether commercial aviation could profitably use the more advanced forms of heat engines giving specific consumptions of 0.3 lb/b.h.p./hr.

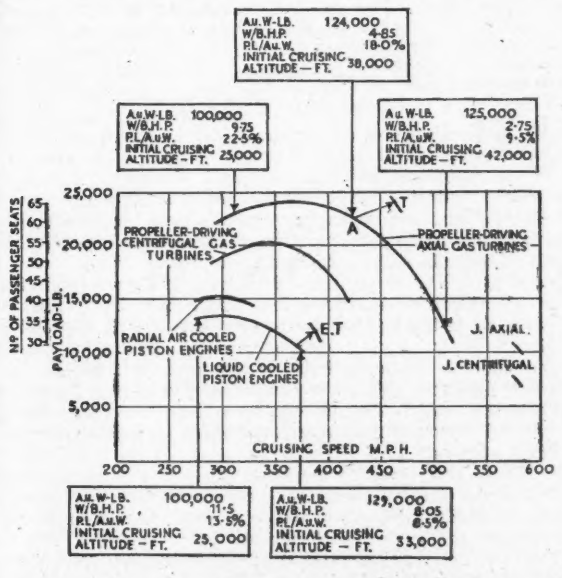



**Fig. 4. Effect of cruising speed on pay load with various engines in aircraft of a given size.**

## MINISTERIAL CREED

"WE believe in flying boats," said Mr. Ivor Thomas at a civil aviation dinner given by the Knights of the Round Table Club in London on March 11th. He added that such a belief was natural in a maritime nation. Viscount Bennett, the former Canadian Prime Minister, presided at the dinner, which was attended by a large number of prominent people in the civil aviation world. So far as civil aircraft were concerned, Mr. Thomas estimated that in three or four years' time this country would be able to hold its own with any other country in the world, in spite of the fact that the designs for the majority of aircraft nowadays were out of date when they left the drawing board.

On the subject of airfields, he suggested that the outlook for Heathrow was not so black as was often painted, and that an announcement could be expected shortly regarding the general airfield pattern for the U.K. Other speeches were made by Sir Frederick Handley Page, Sir Bertram Jones, Mr. A. C. R. Carter, and Wing Cdr. Geoffrey Cooper.

## LOSS OF SHETLAND I

THE chief inspector of accidents, Air Ministry, has now issued the results of his enquiry into the loss by fire, on January 28th, of the Short Shetland flying boat at its moorings off Felixstowe. He has reached the conclusion that the fire was caused by the overheating of the auxiliary engine in the hull. This appears to have been caused by the omission of the leading aircraftsman to open the cooling shutters when starting the engine on the morning of January 28th. The two leading aircraftmen who were on board were unable to prevent the fire from spreading, and the Shetland sank.

It will be recalled that the Shetland was undergoing tests at Felixstowe at the time, many of which had been made while others were to follow. The loss, although serious, is not irremediable as a second boat is fairly far advanced at the Rochester works of Shorts.

# Jet Propulsion and Military Aircraft

## *Abundance of Thrust Can be Used Effectively for Climb*

By W. G. CARTER F.R.Ae.S.

THE association of gas turbines with aircraft designed to make effective use of the special characteristics of jet propulsion has brought the trend of development into a state of transition and uneasy experiment. Already speeds equivalent to a low-level Mach number of 0.80 have been recorded under observed conditions. This has been done by a standard twin-jet fighter not specially designed to accomplish speeds exceeding a low-level Mach number of 0.66. The general handling qualities of the aircraft have been good, and although changes in the aerodynamic characteristics are just beginning to be noticeable, these are regarded as moderate in effect and generally in line with predictions which had been made. It may, therefore, be possible to make more advanced explorations into the transonic region with similar twin-jet installations.

The percentage increase in drag over the low-speed value, as shown by Fig. 1, gives a clear indication that the prospects are there if successfully exploited. The curve is not necessarily an accurate representation, as the available thrust has yet to be calibrated in flight. Up to a Mach number of 0.825 it may, however, be regarded as reasonably accurate, and the extrapolation beyond this figure is the best guess that can be made at the present time.

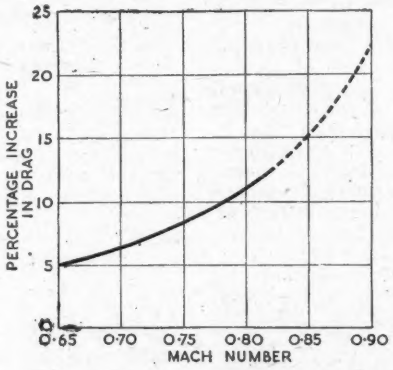



**Fig. 1. Increase of drag with Mach number. The dotted portion is the best extrapolation that can be made at present.**

This curve provides a clear indication that the twin-jet arrangement belies somewhat the first impression that, because of wing nacelles, it may not be so favourable for speed development as compared with its counterpart, the single-jet fighter. The low-speed drag value of the twin will obviously be higher, perhaps as much as 50 per cent higher, than the single-jet machine designed to satisfy the same general operational requirements. But percentage increase in drag is the critical factor, and experience is beginning to show that wing nacelles do not greatly influence the rise in drag due to compressibility effects. Like the fuselage, they are three-dimensional bodies and, if precautions are observed to harmonize the associated airflow characteristics of wing and nacelle, there seems to be no reason to suppose that flight velocities exceeding sonic conditions could not be accomplished with engines on the wings.

### Nacelle Effects

The main concern with the twin-jet arrangement is to minimise the severity of buffeting effects due to turbulence. Substantial improvements in this direction have been made by lengthening the nacelles of the Gloster Meteor, a feature combining to improve their fineness ratio and separate more widely peak suctions of wing and nacelle as separate items. This, at one step, put the limiting Mach number up to 0.84, whereas unfavourable effects had been recorded with short nacelles at a Mach number of 0.75. No doubt a further increase of Mach number could be achieved by lengthening the nacelles another stage, at the same time improving their shape so as to delay shock-wave effects. It would be a great advantage if research along these lines could be explored in the wind tunnel, but at high Mach number it is impracticable to do these tests except by full-scale flight. The work done at the R.A.E., which was effective up to a Mach number of 0.80, was, however, of incalculable value in providing information without which the process of designing the Gloster E28 and the Meteor could hardly have proceeded on a satisfactory basis.

### Housing the Thrust

With engines installed on the wings, it may be possible to accommodate more thrust in terms of all-up weight than could be done with the single-jet fighter; or a three-engined arrangement could be considered to get even better results in improving the thrust/weight ratio. This over-abundance of thrust, so far as fighter types are concerned, is required for climbing performance rather than for speed. As an indication of the trend in this direction, the Gloster Meteor now has a combined thrust of 7,000 lb. At one time 4,000 lb thrust was looked upon as a reasonable provision for aircraft of this type, and a corresponding figure of 3,000 lb good enough for the single-jet machine. Now the outlook is that, however much thrust can be crammed in, it is unlikely to be more than can be used effectively, especially for climbing performance to great altitudes in the shortest possible time. This has become necessary in order to intercept bomber or reconnaissance types which, with jet engines, will be able to cruise at twice the speed and twice the height that has hitherto been possible. As climbing characteristics depend on the thrust/weight value of the aircraft, the present trend of development will mostly be concerned with giving this the highest possible value.

The outlook is that this can best be done by having two engines instead of one, but before this premise can be firmly established it will be necessary to provide jet engines giving much more thrust per unit frontal area than is obtainable from those having centrifugal compressors. These are inevitably bulky in terms of diameter as compared with the axial, and there is no room for corpulence in the jet fighter whether it is propelled by one or more jets. The Rolls-Royce Nene engine, rated at 4,500 lb thrust, is already outside the diameter limit for fighter-aircraft nacelles, so that the most significant comparison which can be made between various engines concerns their respective thrust value in terms of frontal area more than any other installational feature.

In making these comparisons, there is not much to go on at the present time. The background is scanty enough with centrifugal engines, but with those having axial-flow compressors it is almost non-existent. The first, and so far the only, axials produced in this country were those designed by Metro-Vickers and flown in one of the Meteor prototypes. As the first British experimental type it could be compared, on the basis of performance, with the Whittle

engine as flown in the Gloster E28 jet demonstration aircraft. This Whittle engine has since been developed to give about three times as much thrust. If the same impressive achievement can also be made to apply to the axial engine, over 7,000 lb thrust should be obtainable from the same frontal area.

Looked upon from another point of view, the Rolls-Royce Derwent and Nene engines could be examined to get some idea of the present outlook as regards the centrifugal jet engine. After providing sufficient clearance outside the normal diameter of the Derwent, so that air can enter the rear face of the double-sided compressor, this increases the effective installed diameter to 48in, giving a thrust of about 280 lb/sq. ft. The same process applied to the Nene also gives a similar value. No doubt both engines are capable of being developed to provide more thrust than their present rating, and a guess will be made that the centrifugal may eventually give about 400 lb thrust per unit area.

When the axial type is considered there seems to be no reason why the diameter should much exceed that of the air intake orifice. For the same thrust as the Nene, this diameter will be about 27in. Some further increase is to be expected over the combustion chambers and, making allowance for this and for structural considerations, the effective nacelle diameter should not exceed 33in, indicating a thrust value of about 750 lb per square foot as compared with 400 lb for the centrifugal engine. This may be an optimistic estimate, but if it can be done, the twin-jet fighter may well have an overwhelming advantage.

These slim engines also provide the opportunity to consider their side-by-side installation in a fuselage widened sufficiently for this purpose, but the question of balancing the aircraft satisfactorily becomes difficult with so much weight aft of where the centre of gravity is best positioned. The available space to accommodate fuel is also severely restricted with this arrangement, while the problem involved in ducting the air supply to the engine is an embarrassing feature of the structural assembly.

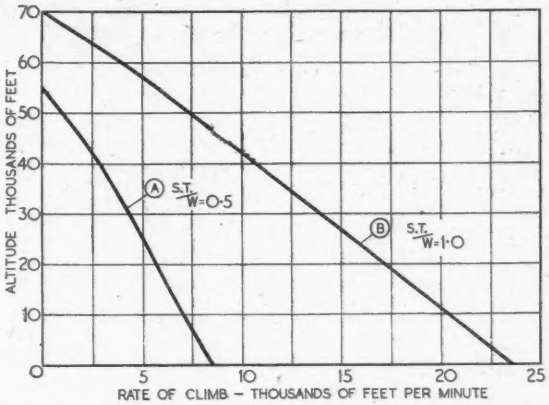



**Fig. 2. Typical climb performance of twin-jet fighters with two different values of thrust loading.**

### Nacelles in Fuselage

There is, of course, ample scope for considering other alternative arrangements, and it may be preferred to put the engines in nacelles forming part of the fuselage. This gets over the difficulty of balancing and provides room for plenty of fuel capacity between the engines. It introduces a difficult problem at the air intakes, and, if conditions here are not good, the breathing capacity of the engine is compromised, and thrust may be reduced under high-speed conditions. One of the outstanding advantages of the twin-jet arrangement is that ducting problems do not have to be taken into account.

The question of engine accessibility is also a matter for special consideration. With a fuselage installation it is not an easy matter to get at the engine for servicing or replacement. The Gloster E28 was most inconvenient in this respect, a relatively unimportant item as it was a non-Service type. In this instance it was necessary to remove a large number of screws from a cover which formed part of the fuselage structure, and it can be imagined that unless careful attention is given to the detail design relating to this feature, it would not be regarded as very acceptable.

These maintenance features are greatly enhanced when twin booms are used as an alternative arrangement for supporting the tail surface. The De Havilland Vampire is a good example of this method of construction, but as development proceeds it may be that the structural characteristics of booms are unsuitable for association with high Mach number velocities. Flight under these conditions can induce very heavy down-loads on the tail. These might be as much as the weight of the aircraft, and exceptional stiffness of the fuselage structure becomes necessary to eliminate the possibility of adverse aerodynamic effects. Another jet fighter, the Lockheed Shooting Star, makes provision for disconnecting the rear fuselage as a complete unit in order to provide access to the engine nacelles. At one time this might have been regarded as a drastic expedient, but it seems to have worked out well in practice. The twin-jet fighter provides an easy solution to these problems concerned with engine accessibility and maintenance.

### Catering for Tail Loads

Some curves given in Fig. 2 emphasize the outlook on climbing performance. Similar and comparable information concerning speed has not been included, as this aspect is more concerned with other features of design, such as aerodynamic refinement and special facilities to maintain precision control of the aircraft under all conditions. These matters relate to the uneasy experiments now rapidly coming into the aeronautical picture, but rates of climb may be very much further advanced before these formidable problems become too obtrusive.

The curve "A" represents a typical rate-of-climb performance for the Gloster Mark IV Meteor. This aircraft has a thrust/weight ratio of 0.5 and climbs to 30,000ft in five minutes. It represents about the best climbing performance for the present-day jet fighter. If a thrust/weight ratio of unity could be developed for a similar type of aircraft, rates of climb as shown by curve "B" would become possible. This can only be done by using axial-flow engines developed to provide a thrust of about 700 lb per square foot of nacelle frontal area. The climbing performance of one of these engines in a single-jet fighter would not be nearly so good.

The alternative power installation for high-altitude interception would comprise rocket assistance. For this purpose, jet engines on the wings make it convenient to put the rocket combustion chamber at the rear end of the fuselage. As a type, the rocket-cum-jet interceptor combines the advantage of out-climbing the conventional jet fighter, with the possibility of cruising facilities at the desired altitude. How far the trend of development may proceed in this direction depends largely on to what extent it may be possible to improve gas turbine jet installations so that these can function satisfactorily without the need for rocket assistance.

Some of the work done in Germany has been much concerned with unconventional arrangements in order to get the utmost performance from a given thrust. These are aspects which cannot be neglected if leading towards a more efficient jet installation. As such, these developments are worthy of careful study and possibly, in some instances, verification by experimental means. On the other hand, the presumed advantage may be more than outweighed by the prospect of sacrificing good handling qualities over some parts of the speed range. It is vitally important

*(Concluded on page 292)*

# HERE AND THERE

**NO STANDING : The surprising capacity of the Miles Aerovan is demonstrated by its ability to take—if only just—a saloon motor car. Its four passengers, if not too massive, might also travel with it.**

## Knighted

ON Wednesday of last week Air Marshall H. E. Wigglesworth was received in audience by the King at Buckingham Palace where he was knighted and invested with the K.B.E. This was on occasion of Air Marshal Wigglesworth's being appointed Air Officer in Command and Chief of the Air Mission, Control Commission, British Air Forces of Occupation.

## Ebb and Flow

A NUMBER of U.S. aircraft manufacturers, whose employment figures dropped sharply after VJ-Day, are now building them up again almost to the same level as they get into their peacetime production stride. Republic, for example, which dropped from 8,000 workers to 3,700, is now back to 5,400 and may have 7,500 by August.

## Airport for Sale

AIRWORK, Ltd., have offered £54,000 to Perth Council for Scone Airport, and the town's "aerodrome committee" has recommended that the council should sell at this figure.

It is understood that the offer covers the whole of the land occupied by the airport together with the buildings and their furnishings and fittings and all other equipment belonging to the town council.

## Well Worth a Visit

AERIAL photographs taken during the flight of the *Aries* over the North Pole, and enlargements of photographs of key objectives during the war, will be included in the exhibition illustrating the development of aerial photography which will be open from March 25th to April 7th at the Royal Geographical Society, Kensington Gore, by arrangement with the Air Ministry.

Hitherto unpublished information about radar will be given in a lecture on "Air Survey" by Lt.-Col. C. A. Hart on the opening day, when Viscount Stansgate, Secretary for Air, will visit the exhibition. The uses of aerial photography in agriculture and forestry will be described in another lecture on March 28th and will be shown in some of the exhibits.

## The Play's the Thing

IN order to provide more "live" entertainment for the R.A.F. and W.A.A.F. at the more isolated stations in Germany, theatrical repertory companies are being formed by the British Air Forces of Occupation from locally recruited talent.

These companies are to tour the British Zone with straight plays and revues, and it is hoped to have two of each "on the road" by the end of April, with two more in rehearsal.

## Compact and Modern

THAT the makers of a British light aircraft which so distinguished itself during the war under the R.A.F. name of Auster should adopt this Service name for the company itself, is surely a sign of their progressive outlook. Auster Aircraft, Ltd., is a more euphonious title than was Taylorcraft Aeroplanes (England), Ltd., and there are other advantages.

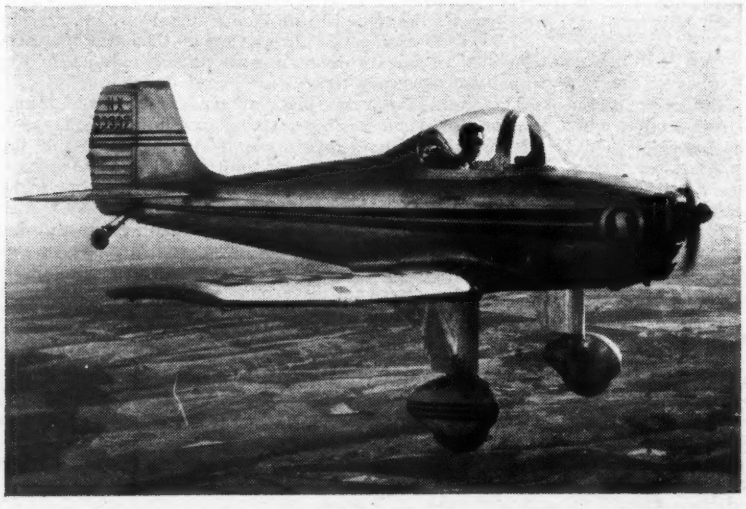
It will fit more easily into the appropriate space on customers' cheques, it avoids any possible confusion with the American Taylorcraft, and, finally, it is more up to date in that it substitutes "aircraft" for that outmoded hybrid, "aeroplane."

## Back to the Land

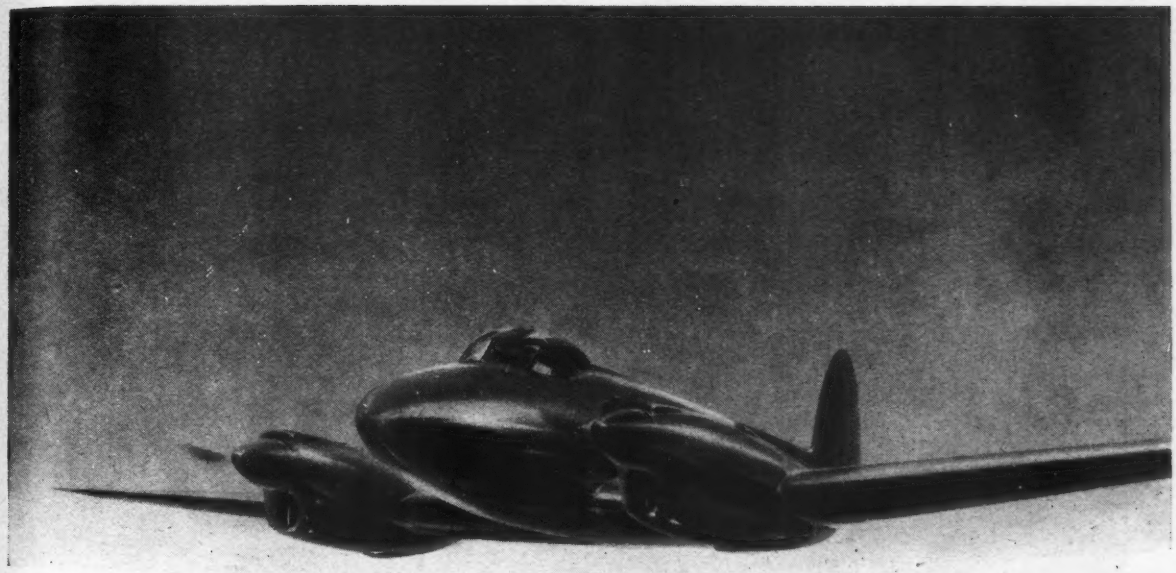
OUT of some 650 airfields in England and Wales, about 100 grass airfields have already been, or are being derequisitioned and will go back under the plough to help in meeting the acute food situation, according to a recent statement by the Air Ministry.

An enquiry is being made into the peacetime requirements of the R.A.F. and civil aviation, and upon the results of this will depend the return of other airfields to agriculture.

In the meantime, 195 of these airfields have been placed at the disposal of the Ministry of Agriculture for varying degrees of agricultural use, ranging from unrestricted use down to grazing only.



**135 M.P.H. ON 65 H.P. : Interesting because it re-affirms the possibilities of the high efficiency single-seater, the all-metal Luscombe Model 10 looks rather larger than the Chiltons, Tipsys and Darts of our own pre-war light aircraft utopia. The engine is a Continental flat-four.**



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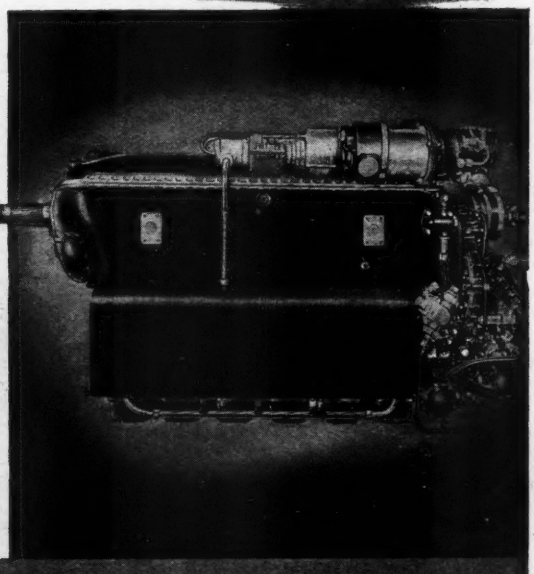

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Smee's

## HERE AND THERE

In some cases, ploughing is being permitted up to the grass margins of the concrete runways which must at present be retained in a firm condition for future flying.

### No. 56 Sqn. in Berlin

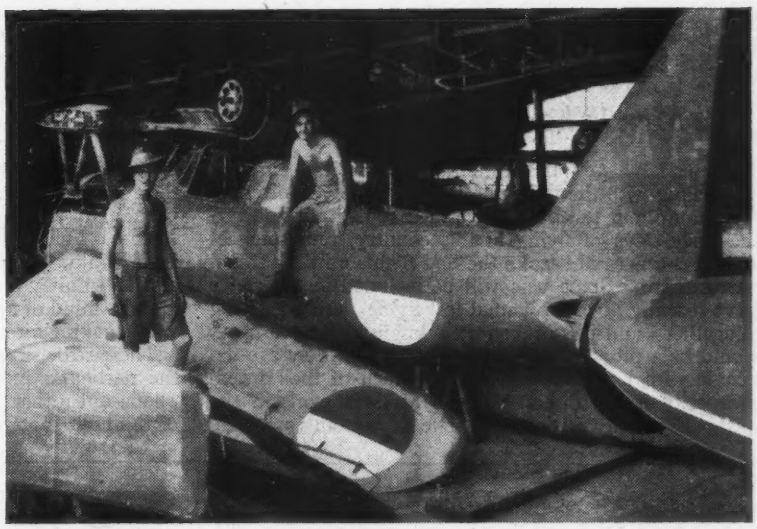
NO. 56 (Punjab) Squadron has replaced No. 33 Squadron at Gatow airfield in the British zone in Berlin. It is equipped with Tempests and is commanded by Sqn. Ldr. M. P. Kilburn, D.F.C.

No. 56 Squadron has an outstanding history. In the 1914-18 war both Capt. Ball and Capt. McCudden won their V.C.s while serving in it.

In this last war the squadron was originally equipped with Hurricanes and by the end of the Battle of Britain had 88 enemy aircraft on the scoreboard.

The squadron was the first to get Typhoons and shortly after D day converted to Tempests. The pilots on Tempests accounted for 74 flying bombs in the defence of London.

The complete score of enemy aircraft destroyed by No. 56 in this war is 149.



**PESTS' NEST: These Japanese aircraft, in various stages of "u.s." were found with Indonesian markings when the men of No. 80 Thunderbolt Squadron, R.A.F., took over the airfield and seaplane base at Sourabaya. In the foreground is a Sasebo Pete floatplane, and a Kawanishi Rex is at the back.**

## News in Brief

The first post-war woman pupil in Britain to fly solo completed her "A" licence tests last week at Marshall's Flying School, Cambridge. She is Mrs. R. Morrow-Tait.

* * *

A shuttle air service to speed up the mail of British occupation forces in Japan is to begin next month between the terminus of the U.K.-Singapore air trunk route and Japan. One aircraft will fly each way daily and will also carry personnel, spares and important supplies.

* * *

A new record for the Cairo-Capetown flight has been claimed by two brothers, Capt. Hector Macdonald and Capt. Robert Macdonald. They covered the distance in two hops in 19hr 33min total flying time, which is 51min less than the previous best time set up by a Constellation.

* * *

Two large airfields built at Nassau under the terms of Lend-Lease were handed over to the R.A.F. yesterday by U.S. engineers now in charge of maintenance. The U.S. staff, stationed in Nassau since America entered the war, will leave by the end of the month.

* * *

The Hon. Daniel Steen, Norwegian Minister to Canada, recently announced that a postage stamp commemorating the "Little Norway" air training centre in the Muskoka district of Ontario has been printed by the Canadian Bank Note Company and will soon be released in Norway. He added that a statement would be released when the stamp is issued.

* * *

The Air Ministry has announced that Lord Stangate, Secretary of State for Air, has appointed Mr. Frank Wood to be his private secretary in succession to Mr. G. S. Whittuck who has been promoted.

* * *

Among projected new types of aircraft announced recently by the Chance Vought Aircraft Division of the United Aircraft Corporation are "a jet fighter and one of even more revolutionary design."

* * *

A new fighter, designed and built in Australia, is undergoing its preliminary tests this month. A Melbourne radio report quoted by Reuter says it is "expected to improve on the performance of the Mustang," and that top speed and rate of climb will be announced when the tests are completed.

* * *

When a sale of £200,000 worth of machine tools was held last week at the Napier aircraft engine shadow factory at Liverpool by the Ministry of Supply, potential buyers began to queue up at 6 a.m. although the sale was not due to start until 10 a.m. Some 500 persons are reported to have attended, and all the best "lots" had been snapped up within about ten minutes of the eager crowd being admitted.

* * *

The Boeing aircraft plant, built at Ottawa during the war, which produced flying-boats and B-29 components, has now been turned over for workshops and storage to the Canadian Army and the Department of Transport.

* * *

Capt. David Barclay, chief pilot of Scottish Airways at Renfrew, has been promoted to the post of air superintendent, and has received from the directors a silver salver recording the achievement of 1,000,000 flying miles in the company's service. The signatures of all the directors are also inscribed on it.

* * *

First winner of the Walter Capley Scholarship, founded at Miles Aircraft, Ltd., just over a year ago in memory of their test pilot of that name, has been won by Peter Ledger of the experimental department and is for three years at London University. Young people who have completed three years continuous service at the factory before reaching the age of 21 are eligible and the scholarships, which may be for one, two, or three years, have a gross value of £220 per annum.

AIRSTRIP . . . No. 6

# Britain's Test Pilots

## *The Men Who Make Flying Safe for Others : Some Interesting Stories Told*

IN this issue we publish the first of a scries of articles dealing with the men who fly our prototype aircraft. Many of our test pilots have their roots right down in the early days of flying in this country, and some of these old-timers still make the first flights on their firms' new aircraft. Some who will be included in the series have recently given up actual test flying—but not flying altogether—and have taken on administrative work. It would be a pity to leave these out because they are the people with long experience, and much of their firms' prosperity is the direct outcome of their work in the past. Especially during the hectic days from 1935 until 1946, with the ever-increasing tempo of the air war, have the test pilots done a wonderful job. A big price has been paid to protect the lives of many Pilot Officer Prunes. Fellows like Jerry Sayer, Chris Staniland, Ken Seth Smith, John Crosby Warren, Johnny Hindmarsh and Bill Bailey are but a few names that come immediately to mind of first-class pilots who have lost their lives while making aircraft safe for the other man to fly.

These articles will not be analytical dissertations on the particular methods employed by the different test pilots, but rather pictures of their background and some of the high spots in their careers.

### No. 1. CAPT. CYRIL F. UWINS,

### *Chief Test Pilot of Bristol Aeroplane Company*

*"Flight" photograph.*

**Capt. C. F. Uwins, O.B.E., A.F.C., F.R.Ae.S.**

PAPA UWINS, as he is affectionately known, probably holds the world's record for first flights. He has flown no fewer than 58 genuine prototype aircraft. His flying hours amount to 4,400, but test pilots do not build up tremendous flying hourage; it is the airline pilot who does this. He was seconded from the R.A.F., shortly after its inception in 1918, to the Bristol Company as a test pilot, and after demobilization joined the company as a civilian on April 1st, 1919. He made the second flight in the Bristol Scout F which had the first 14-cylinder Cosmos Mercury (later Bristol) engine. The first type Uwins had entirely as his own responsibility was the two-seater Badger fighter. Since then he has done the first flights on all Bristol aircraft and, between the wars, did most of the development flying as well. Much of the engine test flying has also been done by him.

One of the most—for him—exciting types was the bulbous Racer monoplane of 1922 vintage. This aircraft was much before its time and experience of its type was nil. It was highly streamlined according to standards of those days, with a thin wing and a retractable undercarriage.

Almost as soon as Uwins got the Racer off the ground the wings started to flex and the machine's motion developed into a roll, first to the left and then to the right. All that could be done was to turn gradually by over-banking to the left until the circuit was completed and a landing made. Before the second flight the wing was braced and the spinner painted. The bracing improved the controls but the extra weight of the paint was sufficient to cause the ultra-lightweight spinner to disintegrate and as it flew off it destroyed the pitot head and very nearly smashed the port wing.

In 1927, on the Bagshot, which had wings of multi-spar metal construction, Uwins experienced what was one of the first genuine cases of reversal of aileron control. It must have been very disconcerting when making a turn to the left to have the aircraft decide to change abruptly to the right. The cause was deformation of the wing by air pressure when an aileron was raised. Whatever happened to an aircraft in the air in those days, a pilot had to stick to his machine and do his very utmost to bring it down safely somehow—for the very good reason that he did not have any parachute with which to bale out.

Uwins's narrowest squeak, according to his own confession, was caused by what is now known in the R.A.F. as finger trouble. Taking up a Bristol Bulldog IV to do a series of speeds-at-height, he put on an oxygen mask and at the appropriate height turned on the gas. The graphs on the next page show what happened to the Bulldog when he fainted from lack of oxygen at 27,000ft as he started to do a level run. From this faint he recovered at 18,000ft and—such is the effect of oxygen starvation combined with the automatic self-discipline of a test pilot of Uwins's calibre—he promptly climbed again to 26,000ft where he passed out once more.

From this second faint he recovered at 20,000ft and then realised that something was wrong. The lack of oxygen fuddled his thinking but he decided that he had more or less "had it" and would have to give up test flying. This was 15 years ago. However, he

**The Bristol Scout F. with Cosmos Mercury engine.**

proceeded to do a level speed run at 20,000ft and then came down to find—when in his right mind once more—that he had not connected the bayonet joint of his mask tube to the supply. As he says, clearly a case for *digitus extractus*.

The late Jerry Sayer once had a somewhat similar experience. When he landed from a flight on a Fury biplane his knee pad read 17,000, 18,000, 19,000, 20,000, 21,000, 22,000, 23,000, 17,000, 18,000, 19,000 and so on up to 23,000 again. He had passed out at 23,000ft and recovered at 17,000ft but never knew it until after he had landed.

Uwins was, in fact, very good at high-flying and in 1932 on a Pegasus-engined Vickers Vespa he broke the world's height record by climbing to 43,976ft. In connection with this flight he had some of the earliest flying experience with highly supercharged engines. He also did much of the test flying on the Bristol 138 on which the R.A.F. pilots broke the world's height record. The 138 had the earliest two-stage supercharger.

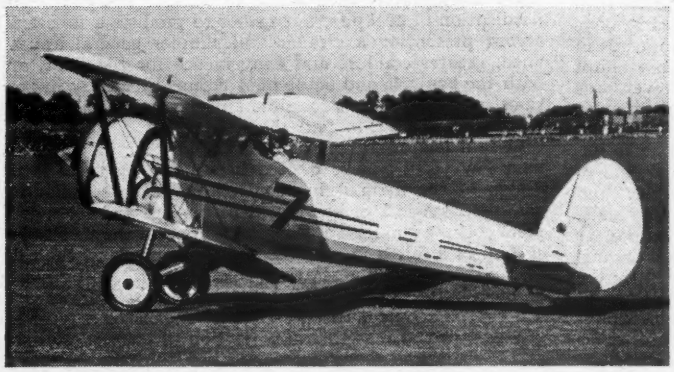
One of his most interesting trips was in the 1920s when he took a Jupiter-engined Bristol Fighter with a ski undercarriage to North Sweden for a demonstration. The Swedes particularly wanted easy starting under Arctic conditions. He found the special aero-quality oil normally used was much too thick so he went to the local garage and bought sufficient ordinary Vacuum R for the purpose. With this he could start up and be in the air within seven minutes, easily beating his competitors.

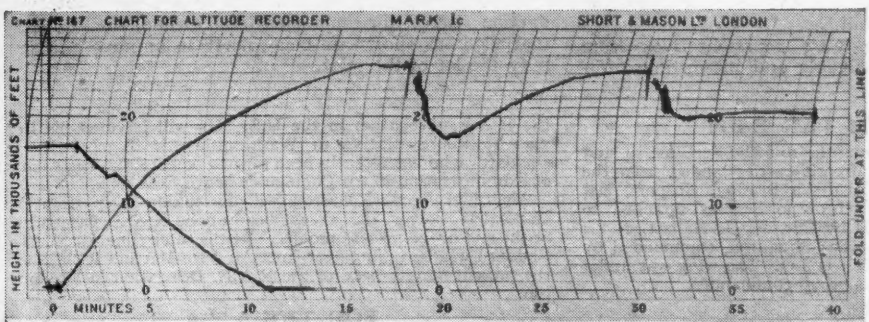
**In this Bristol Racer of 1922 vintage can be seen the elements of the modern high-performance monoplane.**

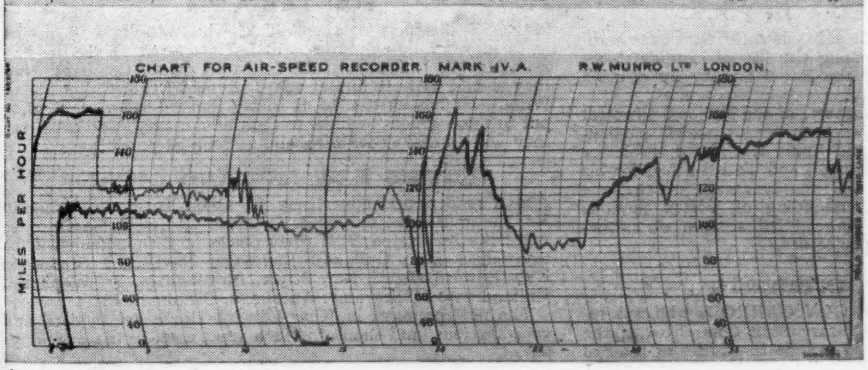
In his long life of aircraft testing Capt. Uwins considers the jump from biplanes to the "Britain First" monoplane, the forerunner of the Blenheim, to have been the most interesting of all periods of test flying. There was an immediate increase of 100 m.p.h. in speed, stressed skin construction, a big increase in wing loading, a retractable undercarriage and variable-pitch airscrews. Here, of course, was where experience told, because he had been playing with all these features in an elementary way in the Racer over 12 years earlier.

To-day, he is turning from "performance at any price," which is always the dominant feature of wartime aircraft and engine design, to the production of ultra economy in the air. The most recent prototype he has flown from Bristol is the Type 170, which will become the Freighter and Wayfarer. Probably this is very dull routine work by comparison with such aircraft as Beaufighter, Buckmaster, Buckingham and Brigand. But one never knows. Even the dullest types can produce excitement at times.

With the Brabazon I looming in the distance, Uwins is making a careful study of the behaviour of really big aircraft. He lectures frequently at Boscombe Down to officers taking the Test Pilots' Course and keeps a team of ten test pilots busy at Filton. J.Y.






**(Top) The Bulldog IV on which Uwins "passed out" twice in one flight. The top graph is from the aneroid barometer and shows clearly the two dives out of control. At the bottom is the correlative graph from the airspeed recorder. Apparently the Bulldog did a series of stalls and dives.**

# Control Cabin Layout

## *An M.A.P. Postscript to a "Flight" Article : What is Being Done*

THE complicated problems involved in the design of orderly and convenient control and instrument layouts are becoming of still greater interest and importance from year to year. In *Flight* of December 13th last, the subject was discussed *in extenso* by a pilot who made an ingenious suggestion whereby all the controls and instruments would be classified and grouped by colour according to their place in the normal cockpit "drill." In this short article, which is published below with the blessings of the Ministry of Aircraft Production, some up-to-date and "official" views are expressed.

---

FLYING has indeed become a very complex business. More equipment of greater bulk and complication now has to be installed in an aircraft cockpit. Modification after modification to new designs often causes the cockpit to be very small, but it is still not possible to modify the human being whose job it is to fly the aircraft. All efforts to produce a Man, Mark II, of reduced size, but with an extra pair of hands, having failed, the alternative has been adopted of making the cockpit the most satisfactory work-place possible for the pilot. British scientists have initiated much research with that end in view.

Experts at the Ministry of Aircraft Production and the Royal Aircraft Establishment first concentrated on the plan of standardizing cockpit layout, and during the early days of the war R.A.E. constructed and exhibited mock-ups of single-seater and side-by-side-seater cockpits in an attempt thus to standardize layouts. This attempt, however, was short-lived owing to the rapid development of equipment and the inflexibility of standardization.

In February, 1945, all the work then being done to improve cockpit layout was co-ordinated under a section of the Ministry of Aircraft Production, and advice and opinions were sought from experienced pilots of Commands, Experimental Establishments and Development Units, as well as from designers and technicians throughout the aircraft industry. Valuable information was provided by the Directorate of Accident Prevention and the Institute of Aviation Medicine, who were consulted so that the physiological and psychological aspect should not be overlooked. At a series of meetings the whole question of location of controls and equipment in the pilot's cockpit was discussed in the greatest detail.

At these meetings also were representatives from America, who had much valuable and interesting information to give, and who returned to their own country with many British ideas which they hoped to adopt. Altogether, the fullest exchange of ideas and information has been made between those responsible in Britain and America and a very large measure of agreement has been reached on the general question of cockpit layout. There is obviously much to be gained by adopting principles of layout common to all aircraft, and it is to be hoped that this welcome interchange of ideas will continue.

### Reasonable Expectation

No attempt has been made to achieve complete standardization of cockpits, but rather to produce a functional layout presenting a cleaner and simpler general appearance, greater comfort and convenience for the pilot, and with the controls and equipment grouped logically in positions where they are accessible and where the pilot might reasonably expect to find them.

Only a few of the improvements likely to appear in the next few years can be quoted here. Among them is the design of the main flying controls so that the pilot has complete freedom of movement of his legs and feet; complete cockpit flooring; a general adoption of the "console" system of a faired-in mounting of the controls at the sides of the cockpit. Undercarriage operation will be by means of push-button controls mounted immediately forward of the throttles, and flap operation by means of a lever aft of the throttles. With the perfection of completely automatic operation, many controls will disappear.

Although few of these ideas will be incorporated in production aircraft for some considerable time, they do show that vigorous efforts are being made to improve and simplify the lot of the pilot.

---

### HOME FROM FAR EAST

THE first complete wing of aircraft from the Far East to land in this country from an aircraft carrier landed from the *Indefatigable* at the Royal Naval Air Station, Gosport, last week. The wing was composed of 30 Seafires attached to No. 887 Squadron, commanded by Cdr. N. G. Hallett, R.N., D.S.C. and Two Bars, and No. 894 Squadron, commanded by Lt. Cdr. J. Crossman, R.N.V.R., D.S.O. The wing was under the command of Cdr. Hallett as group commander.

### RECOMMENDED FOR F.R.S.

TWO scientists who have made valuable contributions to aeronautical knowledge are among the list of candidates recommended by the Council of the Royal Society for election to-day as Fellows of the Society.

They are Robert Alexander Frazer, of the National Physical Laboratory, distinguished for work on aerodynamics, particularly on problems of flutter, and Louis Rosenhead, professor of applied mathematics at Liverpool, and distinguished for his researches in hydrodynamics and aerodynamics, which have contributed to the fuller understanding of vortex motion. During the war Professor Rosenhead led a team of mathematicians working on rocket projectiles.

### R.A.F. APPOINTMENTS

AIR CHIEF MARSHAL SIR GUY GARROD, who was recently appointed to the Military Staff Committee of the United Nations, will shortly also assume the duties of head of the R.A.F. delegation in the U.S. He will have as his Permanent Representative in Washington Air Marshal R. V. Goddard, who has recently been serving as Air Officer in Charge of Administration in Air Command, South East Asia.

Air Chief Marshal Garrod will be taking over from Air Marshal D. Colyer, the present head of the R.A.F. Delegation, at the end of the present month. At the same time Air Marshal Goddard will be taking over from Air Vice-Marshal R. Willock, the present deputy head of the R.A.F. Delegation in Washington.

### FOR THE A.T.A.

THOSE members of the A.T.A. who were injured in the course of flying duties will be interested in the request from Mr. W. J. Drake, of the Decca Navigator Company, that they should write to him at 103, Ladyfield Road, Chippenham, Wilts. He has written to us to say that he has a proposal to put to them which "will be to their advantage," and asks that they will communicate with him as soon as possible.

### ILIFFE'S NEW MIDLAND OFFICES

OUR readers and advertisers are asked to note a change in the address of our Midland office. As from March 25th, 1946, the Associated Iliffe Press offices in Birmingham will be transferred from Guildhall Buildings, Navigation Street, to King Edward House, New Street, Birmingham, 2 (Telephone: Midland 7191; Telegrams: Autopress, Birmingham).

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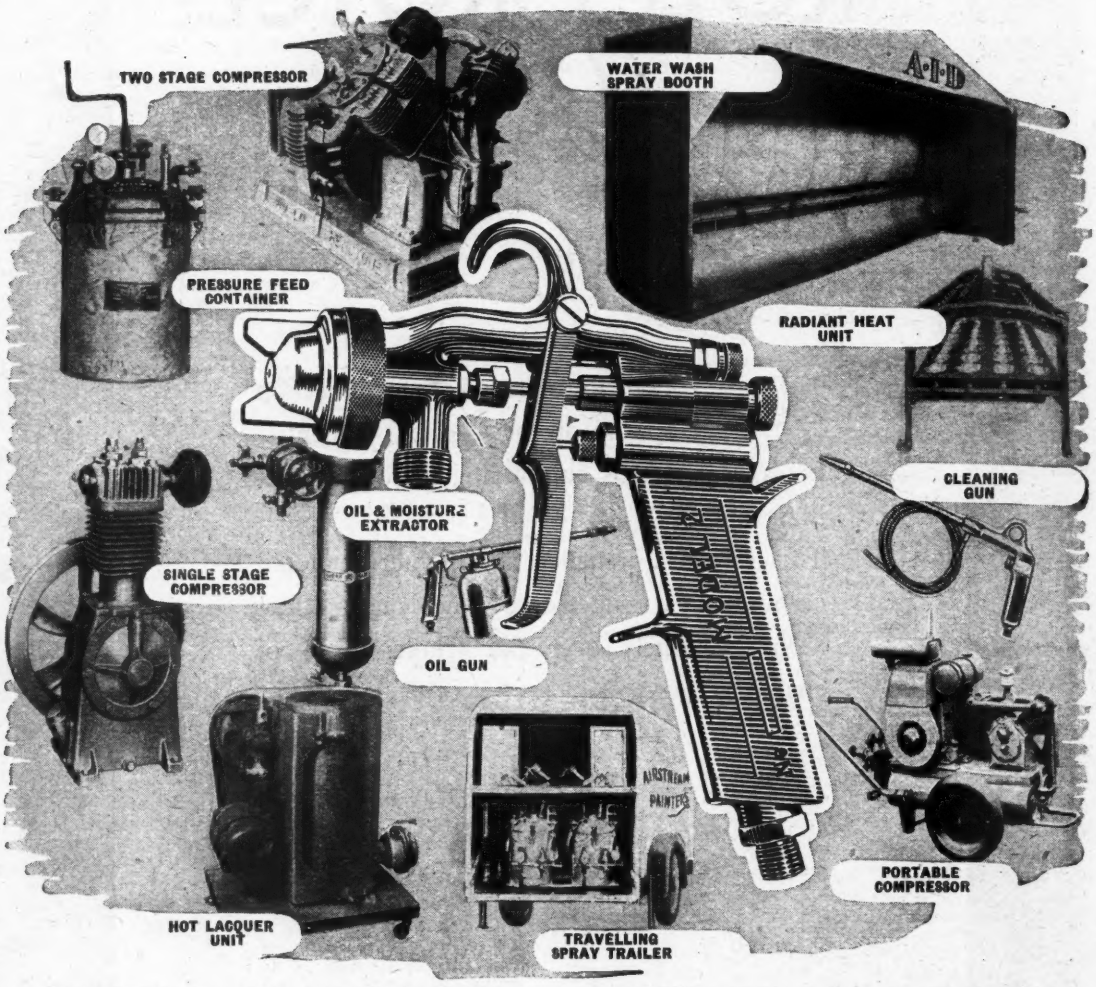


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*Scientific* A 12A

# R.Ae.S. Debates the Gas Turbine

## *Its Application to Aircraft Propulsion*

By Dr. S. G. HOOKER, B.Sc., A.R.C.S., D.I.C., D.Phil.

ON pp. 281-285 of this issue we publish summaries of the Papers on gas turbines in civil and military aircraft, read by Mr. R. M. Clarkson and Mr. W. G. Carter respectively, before the R.Ae.S. last week. Following are extracts from Dr. Hooker's paper.

Dr. Hooker drew comparisons between the power-weight ratios and cruising performances of various aircraft, from which he adduced that, although improvements can undoubtedly be made in the streamlining of aircraft, it is clear that new advanced types will require a take-off power-weight ratio of the order of 4 : 1 if cruising speeds in the neighbourhood of 350 m.p.h. at the normal figure of 50 per cent maximum power are to be achieved.

After outlining the principal advantages possessed by the gas turbine over the piston engine, Dr. Hooker went on to say that an engine of the Merlin category develops about 1,000 b.h.p. for an air consumption of 120 lb/min. Hence each pound of air consumed per second yields 500 b.h.p. which, with an airscrew efficiency of 80 per cent, gives 400 thrust h.p. By contrast, the Derwent V jet engine on the world's record runs at 600 m.p.h. consumed 2½ tons of air/min, or nearly 86 lb/sec. Under this condition the engine produced about 500 thrust h.p., i.e., about 60 thrust h.p. per pound of air consumed per second.

The Derwent V weighs 1,250 lb and for an equivalent h.p. of 10,000 gives a specific weight of 0.125 lb per equivalent b.h.p., this being only one-eighth that of the conventional reciprocating engine. The moral of this is that at speeds in excess of about 500 m.p.h. the simple single-stage jet propulsion engine is far better than the reciprocating piston engine for aircraft propulsion, and is just as economical. Its overall fuel consumption is larger simply because it produces enormous power for its small bulk and weight.

In considering the gas turbine we must take into account the phenomenal rate of progress on these units. Provided that financial support is forthcoming and the wartime rate of development is maintained, we can confidently look forward to continued progress which will have far-reaching reactions upon aircraft design. In this connection a difficulty arises in the timing of the final marriage of the aircraft and the engines. Before a large modern aircraft can be designed and made, several generations of gas turbines may have become obsolete, and therefore it behoves us to be bold and optimistic in our outlook on aircraft.

*. . . cruising speeds of 350 m.p.h. at the normal figure of 50 per cent. maximum power.*

*. . . the Derwent V. jet engine on the world's record runs consumed 2½ tons of air per minute.*

Dr. Hooker then touched upon the relative efficiencies of jet propulsion and airscrew propulsion, saying that the criticism of high fuel consumption is continually levelled at gas turbine engines. This criticism, he continued, is only justifiable for aircraft speeds of less than 450 m.p.h. since at speeds greater than this the jet is as efficient as the airscrew, and the overall thermal efficiency of the gas turbine-cum-jet combination is equal to the overall thermal efficiency of the piston engine-cum-airscrew combination. In the speed range of less than 450 m.p.h. there is no need for the gas turbine to suffer the disadvantage of jet propulsion, and an immediate palliative can be obtained by fitting an airscrew to a gas turbine unit as has been done in the case of the Rolls-Royce Trent engine.

Our attack on fuel consumption for turbines must be made in increasing the maximum compression ratio of the cycle, and this can evidently be done by replacing the single-stage compressor by a two-stage, or a multi-stage axial compressor; but at the same time, to get the full advantage we must maintain the overall compressor efficiency in conjunction with the increased compression ratio. As the compression ratio or temperature rise through the compressor is increased the efficiency falls, being 80 per cent at 5 : 1 compression or 200 deg C temperature rise, and 75 per cent at 7 : 1 compression or 290 deg C temperature rise. Further, it would appear that whatever the efficiency of the compressor the maximum power per pound of air will be obtained with the temperature rise of 250 deg C which corresponds to a compression ratio of 6 : 1, and thus it is clear that both maximum power and minimum fuel consumption will occur at these values.

*. . . an increase in flame temperature from 1,000 deg K to 1,300 deg K more than doubles the power output.*

*. . . a Lancaster with four Nene engines would have a cruising speed of 400 m.p.h.*

Considering the effect of a two-stage compressor at 6 : 1 ratio upon the performance of a jet propulsion engine having a static take-off rating of 5,500lb thrust, it can be shown that at 400 m.p.h. at 20,000ft the two-stage engine achieves an improvement of roughly 14 per cent in fuel consumption.

Also, let us consider the effect of combining both a two-stage compressor and an airscrew upon the performance of gas turbine engine. The comparison shows that at 400 m.p.h. at 20,000ft the jet engine produces 2,400lb thrust for a fuel consumption of 1.3lb fuel per lb thrust per hour, whereas the compound engine produces 2,200lb thrust with a fuel consumption of 0.67lb fuel/lb thrust/hour, that is, the fuel consumption has now been practically halved.

### Flame Temperature Effects

As a matter of interest let us examine the performance of the compound engine at 300 m.p.h., since we know that at this speed lb thrust and equivalent b.h.p. are identical. At sea-level the engine produces 3,900 b.h.p. with a fuel consumption of 0.58lb/b.h.p. At 20,000ft the figures are 2,500 b.h.p. with a fuel consumption of 0.56lb/b.h.p./hr, whilst at 40,000ft we have 1,300 b.h.p. and 0.55 specific fuel consumption figures, which are very good indeed judged by the best of piston engine performances, particularly when one takes into account that there is no main engine cooling required on gas turbine engines.

The examples given have all been worked out on the basis that the maximum combustion temperature at entry into the turbine is 1,100 deg K (deg Kelvin = abs C)., and this temperature, said Dr. Hooker, is very close to the maximum which turbine blades of Nimonic 80 can withstand at the stresses of a modern gas turbine. Better turbine blade materials are in hand and recourse can be had to such devices as water cooling or air cooling of the blades, and under these conditions high combustion temperatures can be allowed.

Flame temperature has a very important effect upon the gas h.p./lb air/sec available in the jet pipe, i.e., an increase in flame temperature from 1,000 deg K to 1,300 deg K more than doubles the power output of the engine for each pound of air consumed per second. Again, the optimum power occurs at about 250 deg C temperature rise through the compressors. The effect upon fuel consumption is no less marked and the specific consumption falls from about 0.65lb/hr/g.h.p. to about 0.53lb/hr/g.h.p.

The incorporation of a heat exchanger can have a very great effect in reducing fuel consumption and, further, can allow the engine to be operated over a wide range of powers without appreciably affecting the specific fuel consumption, but since a heat exchanger must necessarily be rather heavy and bulky the additional engine weight will only be saved in terms of fuel if the range of the aircraft is sufficiently great. Calculations indicate that somewhat more than five hours'

# R.Ae.S. DEBATES THE GAS TURBINE

flying must be done before a heat exchanger has paid for its own weight. In addition, the problems to be faced in its development make it the radiator problem *in excelsis*.

On the score of performance with jet propulsion, Dr. Hooker illustrated some rather entrancing examples. First, a Lancaster fitted with four Nene engines which gave the aircraft a cruising speed of about 400 m.p.h. at all altitudes up to 35,000ft. At 10,000ft each engine will consume 430 gal/hr, so that the air miles per gallon are 0.23. At 20,000ft the corresponding figure is 0.31 a.m.p.g., and at 30,000ft 0.43 a.m.p.g. Admittedly these are low figures, but it should be remembered that four units of this type when fully installed only weigh a total of about 7,000 lb, whereas the present four Merlins fully installed weigh 13,000 lb.

Further, jet fighter aircraft such as the Meteor, Vampire and Lockheed Shooting Star have drag figures very much lower than airscrew-driven machines of a similar category, e.g., the drag coefficient of the Meteor is only about two-thirds that of the Spitfire, and figures for the Vampire are even better. Consequently, at a conservative estimate the previous figures of a.m.p.g. can, in actual fact, probably be increased by about 25 per cent, and in addition jet engines with a fuel consumption some 14 per cent less than that of the Nene can be designed and made.

So far as take-off is concerned the Lancaster with four Nenes will have a static take-off thrust of 20,000 lb, which is considerably greater than that from four Merlins, and although it is improbable that the Lancaster would be able to fly the Atlantic it is respectfully suggested that it will have little difficulty in crossing the English Channel and reaching very attractive places like Paris, Stockholm, Copenhagen and Zurich.

To consider another case, namely, the celebrated D.C.3. A cruising speed of 400 m.p.h. at 1,000 ft and 5,000 lb payload coupled with a range of 1,000 miles can be obtained at a take-off weight of 27,000 lb, using jet propulsion engines of about 6 : 1 compression ratio and a static thrust of 6,000 lb.

In consideration of the effect of altitude upon range, the preceding figures for the Lancaster give an indication. But to analyse the effect in more detail we may consider a machine of about Spitfire size having a drag of about 1,000 lb at 300 m.p.h. at sea level. For a sea level speed of 500 m.p.h. a thrust of 2,400 lb will be required, and the air-miles/gallon of the machine will be reduced to about 1.0. At 40,000ft the drag of the aircraft at the same speed of 500 m.p.h. will be reduced to about 800 lb, due both to the lower density of the air at this height, and also to the change in angle of incidence of the machine. Consequently, at this altitude the air-miles/gallon will be about 4.0. In going from sea level to 40,000ft the thermal efficiency of the engine is improved from about 18 to 25 per cent, and this improvement is due to the lower air-intake temperature to the engine and the consequent high compression ratio of the cycle. On the other hand, the propulsory efficiency of the jet has fallen from 64 to 58 per cent, due to the increased jet velocity at 40,000ft brought about by the increased thermal efficiency of the engine. Thus the balance is as follows:—

Improvement in thermal efficiency of engine from 18 to 25 per cent, i.e., 1.39.

Reduction in propulsion efficiency from 64 to 58 per cent, i.e., 0.90.

The overall improvement of the engine is, therefore, 25 per cent, but the range of the aircraft has actually been *quadrupled*. Hence the improvement in range of a jet-propelled machine at altitude is not so much due to the engine, but in the main due to the aircraft.

In actual fact, at 40,000ft and 500 m.p.h. this machine does the same air-miles/gallon as a Spitfire, and consequently all the objections to jet propulsion can be overcome by flying high and fast. It should be clearly understood that jet propulsion is efficient at any altitude provided the speed is greater than 500 m.p.h. It should also be remembered that the higher the altitude the more efficient the aircraft.

> *. . . four air miles per gallon on a jet propelled Spitfire at 500 m.p.h. at 40,000ft.*
>
> *. . . it should be clearly understood that jet propulsion is efficient at any altitude, at a greater speed than 500 m.p.h.*

## THE NUFFIELD CENTRE, WARDOUR STREET

SINCE it opened in September, 1943, the Nuffield Centre for Service men and women at 15, Wardour Street, has provided meals, dancing, entertainment, and the facilities of writing rooms, games rooms, tailor's and barber's shops, etc., for nearly three million members of the Forces.

The premises, which are a combination of the former Empire Restaurant and the Café de Paris, are pleasantly "non-Service-Club" in appearance, and at the present time there are still more than 25,000 visitors each week.

Members of *Flight* staff were recently guests at the Centre on the occasion of one of its bi-weekly variety-entertainment evenings. With a list of artistes volunteers topped by Tommy Trinder and compered by Peter Waring, the two-hour show was first class.

It is to be hoped that this excellent club, which is sponsored by the Nuffield Trust for the Forces of the Crown, will be able to continue with its good work as long as there are young men and women in uniform. Great credit and thanks are due to the organizers and staff—the majority of whom give their services voluntarily—and the enthusiasm and obvious pleasure of their visitors must in itself be a reward to them.

Service men and women below commissioned rank who have not yet visited the Centre are strongly recommended to do so next time they happen to be in London.

## Jet Propulsion and Military Aircraft

(*Concluded from page 285*)

that the aircraft should respond to precision control under all conditions.

It can be seen that the working-out of a new equilibrium between attack and defence has only just begun, and that the problems associated with this outlook have become greatly intensified as the tempo of events has been speeded-up. More effective armament installations are also likely to be required, and these may profoundly influence the general trend of design and development. At no other time in the history of aeronautical events have so many intricate and formidable problems been presented for solution.

In this brief review only a few of the aspects concerned with the application of jet propulsion to military aircraft have been mentioned. There are, however, many secondary considerations no less important than those which relate more to the fundamental aspects of design. These associated effects mostly involve the safety and comfort of the pilot, a matter for special consideration now that speed and altitude ranges have been so greatly increased. However good the aircraft may be as a means of transportation for offensive weapons, so much depends upon the man in making the most effective use of the military machine.

## FORTHCOMING EVENTS

March 28th.—*R.Ae.S., "The Electrical Measurement of Strain," by Dr. S. C. Redshaw.

March 28th.—R.A.F. Club annual meeting at 128 Piccadilly, London, W.1, at 6 p.m.

April 4th.—†Metropolitan Region luncheon meeting, Institute of Motor Industry (London).

April 10th.—*R.Ae.S., "The Silencing of Aircraft," by Dr. Fleming.

April 16th.—**R.Ae.S. Graduates and Students Section; "Flight Refuelling," by Sir Alan J. Cobham.

April 25th.—†R.Ae.S., Manchester Branch.

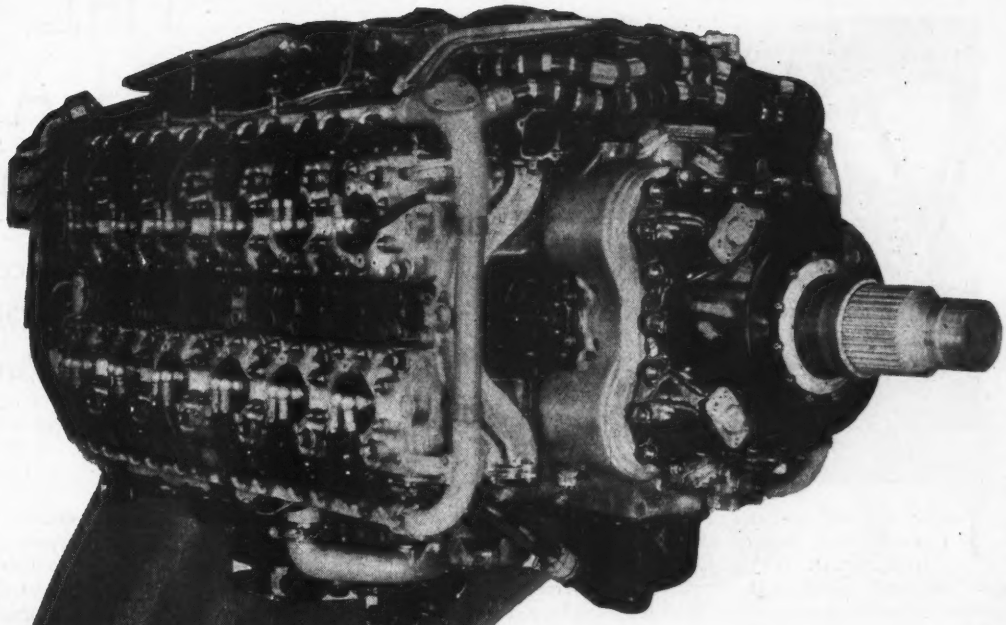
April 25th.—*R.Ae.S., "Modern Aeronautical Materials," by Dr. L. Aitcheson.

May 2nd.—**R.Ae.S. Graduates and Students Section; "Transport Aircraft," by F. Ratcliffe.

* Lecture Hall, Institute of Civil Engineers, Gt. George St., S.W.1.

** The Library, 4 Hamilton Place, W.1.

† Lectures by Air Comdre. F. Whittle.



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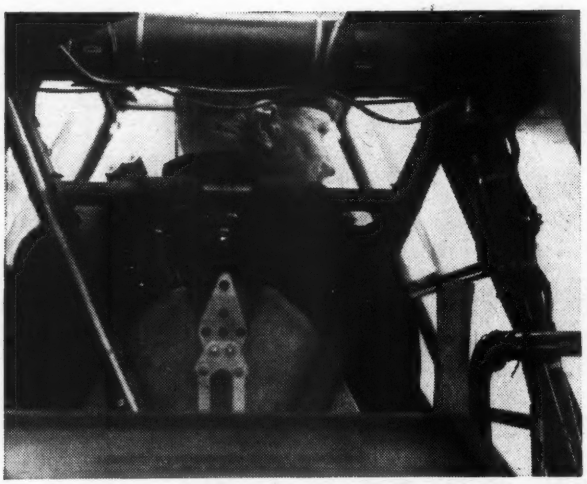


# THE WESTLAND LYSANDER

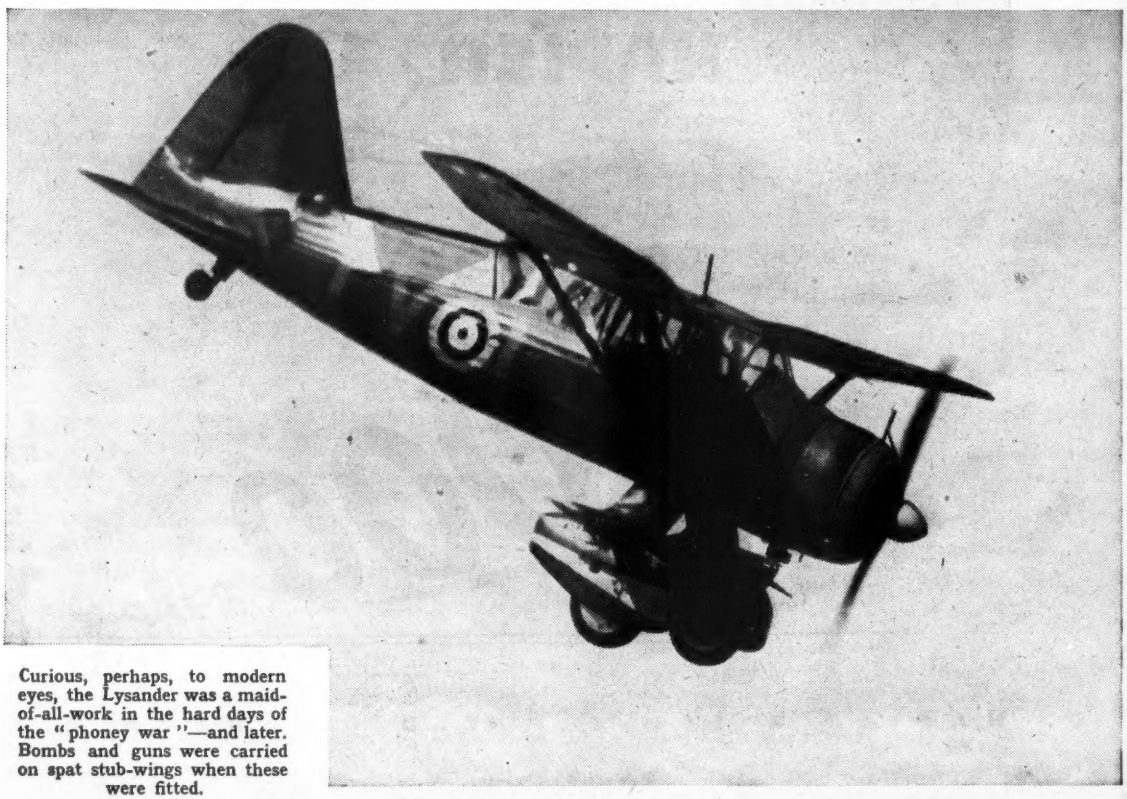
## *Flaps and Slots in Excelsis : Impressions of a Flying Observation Car of the Early War Years*

By "INDICATOR"

IN the days immediately before the war the Westland Lysander had been developing quite a reputation as a trick aircraft for flying displays. Pilots who knew it well could produce the most extraordinary results in the way of helicopter take-offs and dead-stop arrivals. But, as the more casual pilot was later to discover, this sort of flying could only be carried out safely by people who knew what it could and couldn't do.

It was necessary, in fact, to live in the aircraft, ignoring all others, for the best results to be obtained and for it to be fully appreciated. The casual driver found that, while the take-off was phenomenally short, the arrival could only be properly completed at a more or less conventional speed unless the fullest possible use was made of the throttle.

Speaking as one of those who flew the Lizzie "casually" and interspersed with other types—so being without expert knowledge—the trick of a slow arrival seemed to be that of knowing exactly how much power to use, and of adjusting the rate of sink accurately so that the undercarriage, with its internally sprung wheels, would take it comfortably. More than once, too-clever pilots have attempted over-autogyroptic landings and have found, at the very last moment, that more power was needed than could possibly be offered. The result was that the whole outfit disintegrated noisily around them while they sat, looking more than silly, in what was left of the fuselage. The undercarriage and centre-section generally seemed to be extraordinarily tough and, on the few occasions when such unhappy incidents occurred,



**Curious, perhaps, to modern eyes, the Lysander was a maid-of-all-work in the hard days of the "phoney war"—and later. Bombs and guns were carried on spat stub-wings when these were fitted.**

the engine seemed to fall out and the wings to drop off, leaving the fuselage more or less intact.

For the benefit of those for whom the Lysander is now merely an aircraft of historical interest, it should be explained that it had slots along the entire leading edge and that the inner "high lift" portions of these slots operated the flaps. The more or less free outer slot sections used, if I remember correctly, to pop out smartly at about 100-105 m.p.h., while the inner sections, taking the flaps with them, started to open at about 95 m.p.h.

### Variable Flappage

Between this speed and the lowest possible stalling speed—which was almost infinitely variable according to the amount of throttle used and the consequent angle of attack—the flap extension varied. And so, in proportion, did the mild discomfiture of the pilot who had had no previous experience of the type. Since the movement of the flaps naturally altered the fore and aft attitude as well as the apparent trim, it was possible to find oneself making an approach with a kind of rocking motion. Within a certain speed-range the flap movement was somewhat critical. As speed was lost, the slots opened and the flaps went down; so did the nose—a fact which caused the speed to rise again, the slots to close themselves and, consequently, the flaps to close. And so on, *ad infinitum*. Of course, the expert Lysander pilot was never troubled and made sure that the aircraft was held firmly at the right speed at the right moment.

The flap-slot interconnection was ingeniously obtained by purely mechanical means, and in the earlier versions there used to be a locking device on the pilot's left. This was later removed for safety reasons and because it presumably wasn't worth the trouble. Curiously enough, the slots and flaps never appeared to move during a high-speed pull-out—when one might have expected trouble. Aerodynamicists will no doubt be able to explain why.

The vital "drill" action with the Lysander was TRIM. In fact, if, after a landing, the fore and aft trimming control was inadvertently left for the next take-off uncharged in its tail-heavy position, it was not possible to prevent the aircraft, at full throttle, from proceeding upwards in a loop from ground level. Of course, the more knowledgeable drivers would realize their mistake as soon as the throttle had been opened. In this trim setting the aircraft would feel so very tail-heavy that the error would be obvious. With the same expert, even if the outfit became airborne, all might be well; the throttle could be brought back early enough, and the aircraft allowed to sink smartly back on to the ground—or it could be closed far enough to allow the stick to be held while winding madly. During over-shoot procedure it was the normal procedure to open the throttle in penny numbers while alternately winding hard on the big trimmer-wheel.

### Ballastics

A certain question of ballast had to be considered when flying the variously equipped Lysander types at a Maintenance Unit, and it was a lucky pilot who did not, at one time or another, take off with a passenger and his equivalent ballast weight all together in the tail—with the result that he found that two hands were necessary to keep the nose down even when the elevator trimmer had been quickly wound fully forward.

Like so many other aircraft, the Lysander was admired by all who had spent a sufficient number of flying hours in the driver's seat. From the control point of view it was not very satisfactory by modern standards, since the ailerons were somewhat heavy in proportion to the size and power of the machine, but the experts very soon developed suitable biceps to cope with the loadings, and might, even, have found any other aircraft to be dangerously light.

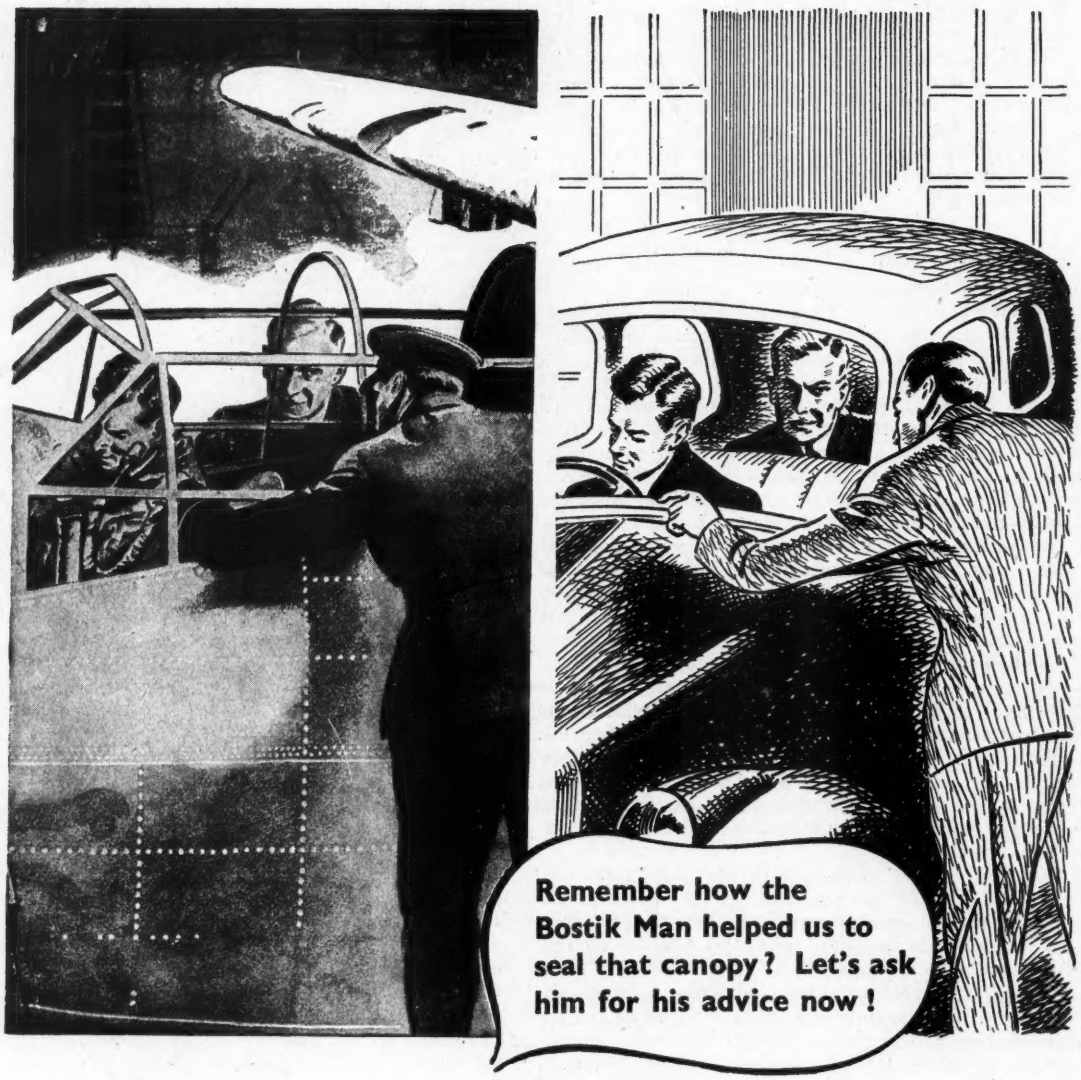
**Exceptional all-round view was one of the designed features of the Lysander. This "plan" view shows the type from one of its prettier aspects.**

One always felt extraordinarily safe when flying about the country in the Lizzie—with the knowledge that it could be sunk, if not without trace, at least without personal damage, into almost any open space. The view, surrounded as one was by acres of movable windows, was superb. One sat high up and looking down and ahead over the engine cowling, while only the struts and, to some small extent, undercarriage (stub-winged or otherwise) interfered with the downward view. In turns, one could look either under or over the wing, and in hot weather it was possible to slide away so much window area that one felt positively naked and even very unsafely poised in space.

Once, on a delivery trip, a group of ferry pilots left Yeovil while a ground fog was creeping over the field, and during the trip to the northwards the ground was not seen again until the Bristol area had been reached. I doubt whether one of us would have gone off in any other type of a single-engined aircraft. Perhaps in those early and inexperienced and war-must-be-won days we felt that the Lysander could be put down safely even on one of the many little hilltops which appeared through the otherwise all-pervading ground mist.

As far as I remember, there were three Marks of Lysander—the I and III with Mercury engines, and the II with the sleeve-valved Perseus. All had two-pitch airscrews. In some of the earlier Mercury-engined versions the power would sometimes tend to fade away at higher altitudes in cold weather unless the carburettor-heater control was intelligently used. Apparently ice would

(*Continued at foot of p.* 293.)

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# CIVIL AVIATION

## Mails by Air

### *Using Night Air Services to Speed Up Internal Delivery*

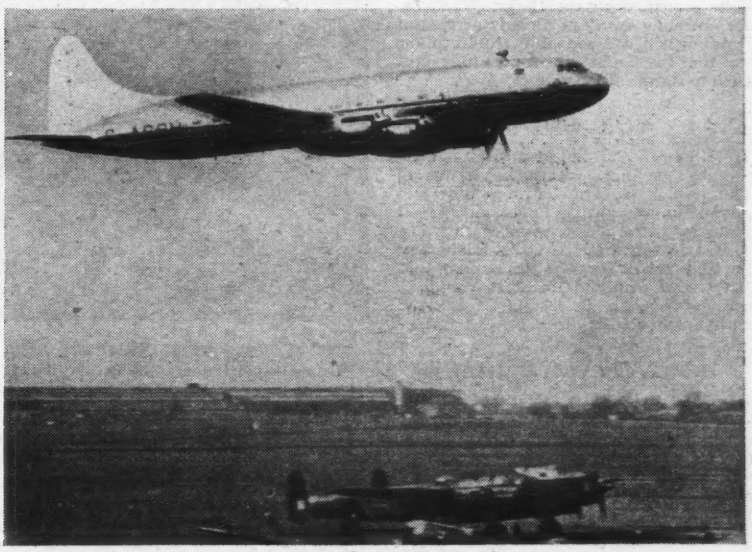
ON learning that the Postmaster-General plans to speed-up mail delivery by the use of night air services the knowledgeable individual is torn between two desires. His first reaction is to praise the Post Office for its foresight and enthusiasm in thus wishing to make use of every possible means for the expedition of mail; his second, as a realist, is to wonder whether, at any rate in this country, the results are likely to be practical within the next ten years.

In spite of the old Pony Express "line" that "the mails must go through," it seems to be more important that they should arrive with regular reliability rather than irregularity with greater dispatch. Knowing our own winter weather and remembering the comparative shortness of the distances involved, it hardly seems that night air services are likely, for some time to come, to be sufficiently reliable, in timing and placing, for such important goods as His Majesty's mail.

Let us be realistic enough to agree that, until navigational systems and de-icing methods are very much more than a hundred per cent better than they are to-day, short-distance air services operated at night are not going to be operated to a very strict time-table. The entire situation is altered when we are dealing with longer distances and with a saving in time which may be anything up to a month; then, any necessary delay of a few hours or days is not of vital importance.

However, the P.M.G. has merely stated that "as night-flying inland services develop" he proposes to make use of them "in suitable cases." So he has given himself a wide margin and only mentions as "priorities" the services to Belfast and Dublin—on which, even if there are occasional hold-ups, the saving in overall time will be sufficiently useful to be worth while. Of course, if the meteorological people, British European Airways and the Post Office can get together to make a quick last-minute decision every day, the letters may at least arrive no later than they would otherwise have done when being sent by surface transport—but one knows how difficult such decisions must always be.

Perhaps one day soon the pre-war all-mail-by-air Empire scheme will be restarted. Such a scheme will be infinitely more valuable than any mere internal use of air services for normal mail delivery.



**FIRST FLIGHT: There could hardly have been anything very seriously wrong with the prototype Tudor II if Mr. S. A. Thorn, Avro's chief test pilot, and his assistant, Capt. Orrell, could bring themselves to make a low-level fly-past for the benefit of photographers and others on the ground. Though intended for medium-stage Empire runs, the Tudor II can have a maximum range of 4,100 miles.**

## The Westland Lysander

*(Concluded from the previous page)*

build up in the jet chamber until no carburation was possible.

Before discovering the reason for the failure and the need for using the hot-air control, we used occasionally to make phenomenal and heroic forced landings—only to find, on later run-up, that there was nothing whatever the matter. Needless to say, if we had persisted in our attempts to obtain a return of power during the whole of each descent, and not just at the start of it, this power would have duly arrived. But, at first, after a few preliminary efforts, we naturally supposed that some form of fuel failure had developed, and believed that it would be much safer to come straight down on to a suitable field or airfield rather than to continue over possibly barren ground with a doubtful engine installation.

Just as biographers and historians are sometimes over-zealous in their criticism of the Victorian days, so I have no doubt been over-critical of a crinolined ancestor of the smooth modern airship. Take no notice; we all enjoyed flying, and (except when among hostile aircraft) felt absurdly safe in this miracle of flappery and slottery.

## Atlantic Talks

### *Slow Progress in Dublin : Difficulties Over Communication Systems and Likely Traffic Density*

THE North Atlantic Route Service Conference of P.I.C.A.O., now through its second week in Dublin, is proving a longer meeting than had been originally expected. This is largely due to the fact that no pattern for such a regional organization exists—the Dublin meeting is the first to be held in each of the ten regions established by P.I.C.A.O.—and much of the work is exploratory, but it will at least have the result of providing a model for the subsequent talks.

Defining the "North Atlantic Region" has not been easy, and the General Committee has advised its sub-committees to give it a liberal—and not strictly geographical—interpretation. This is particularly important to the Meteorological Committee (meeting under Dr. S. Pettersson, professor at Oslo Meteorological Institute), which finds that it must have the service of weather stations outside the immediate North Atlantic area. This committee is also seeking to devise a series of symbols to convey weather information to pilots of all nationalities in the flight forecast folders, as well as a code for the transmission of supplementary information while the aircraft is in flight.

The problem of communications is proving a difficult one because the Americans favour radio-telephony and the European countries are more accustomed to the code system of radio-telegraphy which is necessary to overcome the language difficulty.

The strong American delegation has submitted documents on many aspects of the conference's work, including those on the form of the Route Operations Manual, Air Traffic Control, and the Regional Secretariat. The question of the Secretariat is now under special consideration by a group consisting of U.K., U.S., Canadian, Danish and Spanish delegates.

Area control has been causing a great deal of interest, and the general feeling is that the choice of central control for the region lies between Prestwick and Shannon—with Prestwick as the favoured site. Airports suitable for Atlantic services

## CIVIL AVIATION

have been provisionally listed, but this list is not being divulged until it has been presented to the General Committee. Among decisions already arrived at is one which will probably require pilots on the trans-Atlantic route to report their position at 30-minute intervals.

### FOR INDIA

THIS week a technical mission is leaving for India, at the invitation of the Indian Government, in order to advise on the setting up of an aircraft industry there. The members are Mr. J. V. Connolly and Mr. L. R. Barrett, of the Ministry of Aircraft Production, and Mr. J. D. North and Mr. S. P. Woodley, nominated by the Society of British Aircraft Constructors.

### ARGENTINIAN MILES

WITH the object of establishing a factory in the Argentine for the manufacture of Miles aircraft under licence, a mission, headed by Mr. F. G. Miles, is expected to visit that country shortly. Preliminary arrangements have already been made by Mr. Hugh Bergel, who has just returned from Buenos Aires.

### ANGLO-TURKISH AGREEMENT

TURKEY and London are to be linked by a direct air route, and reciprocal rights are granted to both British and Turkish designated airlines, under the terms of an Anglo-Turkish agreement which has just been published in a White Paper. The agreement was signed in Ankara on February 12th. It is on similar lines to other recent international air agreements, and covers fifth freedom principles.

The route which has been approved for initial operation is from London, via Milan, Rome, Athens and Istanbul, to Ankara. As soon as ground organisation and other conditions permit, however, a new route, via Nuremberg, Budapest and Bucarest to Istanbul and Ankara, will be operated.

### SOP FOR THE SCOTS

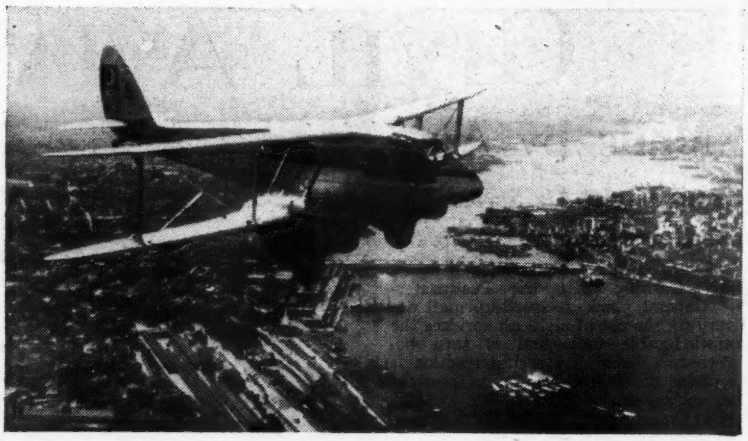
THERE is to be a Scottish Division of British European Airways, and this will be responsible, as a part of that Corporation, for the administration of air services within and radiating from Scotland. There will also be a Scottish Advisory Committee to advise the Corporation. In addition, a Scottish Regional Headquarters will be set up to administer transport airfields in Scotland, including Prestwick, which, incidentally, will be formally designated as an airport for international air services with effect from April 1.

This information was given in the House of Commons last week by Mr. Ivor Thomas when answering a series of questions on Scottish aviation. He made it clear that the making of agreements with other countries for air services is to remain in the hands of the Government, whether or not Scotland is involved.

### AGREEMENT WITH EIRE

AN improved service to Eire is planned in a new air agreement which has been under discussion between the Ministry of Civil Aviation and the Eireann Department of Industry and Commerce. It is understood that the new agreement will represent a marked improvement over the old, which is about to expire. It will enable regular services to be established from Prestwick to Dublin, and Rineanna (the Shannon airport), and also between Doncaster and Dublin, via Liverpool.

Owing to a misunderstanding of the proposed terms of the new agreement, the Prime Minister explained in the House of Commons last Thursday that the Eire Government required all aircraft crossing Eire territory to land at Rineanna airport, as had already been arranged in their agreement of February 1945 with the United States, in connection with the U.S. trans-Atlantic services. Naturally, however, trans-Atlantic aircraft which did not fly over Eire were not subject to such conditions, and, thus, services to and from Prestwick direct were not affected.



**UTILITARIAN REQUIREMENTS : This picture of a Turkish State Airlines D.H. Rapide over Istanbul reminds us all that simplicity and utility in transport aircraft are still good selling points. In recent months de Havillands have sold more than a hundred Rapides both at home and abroad.**

### K.L.M. CHIEF

CAPT. H. SPRY LEVERTON, who has been with K.L.M. since they first started operations, has now been officially appointed to the post of Regional Director for the United Kingdom.

### SOUTH AMERICAN CONFERENCE

WITH the object of arranging matters of mutual interest, such as those concerned with fares and freight weights, the first conference of South American airline operators was held in London recently. The talks were, to use an official expression, " of an exploratory and informal character," and were held, at the British South American Airways' London office and attended by representatives of Swedish A.B.A., Air France, K.L.M. and Pan-Air Do Brazil.

### SHILLINGS FOR PENCE

BY some strange typographical misinterpretation we succeeded, towards the end of the Bristol 170 description in the issue of March 7th, in making this aircraft appear to be a somewhat expensive one to operate. We said, in fact, that the running costs "should approximate to 12s 6d per ton/mile . . . and 10s 2d . . . " The figures should, of course, have read 12.6d and 10.2d respectively. Just one of the disadvantages of the use of the decimal system in a country where typewriters and linotypes can only print decimal points as full stops.

### AEROCAR POINTS

ALTHOUGH the interesting undercarriage details of the Portsmouth Aerocar were planned in outline by the manufacturer's own design staff and the operating pneumatics are being worked out by Dunlops, the undercarriage legs and the nosewheel steering arrangements are being finally developed by Messier Aircraft. This firm has, in fact, put in a great deal of work on the project.

Incidentally, the standard power unit for the Major will be the Cirrus Major III; Gipsy Major 31s may, however, be fitted at the customer's option.

### PRACTICAL ASSISTANCE REQUIRED

LAST month a special committee was formed within the P.I.C.A.O. framework to deal with an unusual request from the Greek Government. This Government stated that it was not able to provide funds and technical means on the scale necessary to restore airfields and facilities along the international air routes within the country, and asked that some assistance should be given at least for the more important requirements.

This request is the first of its kind to come from P.I.C.A.O. and is interesting, in the first place, because the airline facilities offered by Greece are likely to be important to all operators and to B.O.A.C. in particular, and, in the second place, because the answer may form an important precedent. One cannot help wondering who will foot the bill if the necessary assistance is offered.

# American Newsletter

## Politics and the Air Lines : Opinions on Bermuda : Pilots' Strike Threat Reactions

By "KIBITZER"

IN this Newsletter I have already tried to show how American politics can, and very often do, have considerable effect on American, and therefore on world, aviation matters. For a country that has such a wide influence Americans are not, in the main, politically minded in the same sense as many Europeans—although, fortunately, they are becoming more so every day. This is because, apart from some outstanding exceptions, a large number of Americans enter politics not to further their ideals, but to improve their business prospects. Such a state of mind must obviously reflect through all phases of American commerce from top to bottom.

It is therefore quite understandable that lobbying, and even less attractive means of exerting influence, have probably reached greater and more powerful proportions in the States than any other democratic country. Whenever the British read of fights over Atlantic rates or of debates on who shall operate which route where, or of similar discussions—all of which must eventually affect British aviation—they should remember that behind such arguments there may be powerful business-political groups influencing the actions and utterances of the participants.

A very interesting example has arisen over the British-American Bermuda Air Conference, and two of the three following extracts from the New York Press illustrate very clearly how domestic politics can enter the international picture.

(i) Three extracts from an article by a Mr. Don Cook and copyrighted by the New York Tribune, Inc., entitled "Aviation Policies a Compromise." This probably expresses the average non-political reaction to the agreements reached.

"... In abandoning, after a dogged two-year defence, her entrenched position that international civil aviation had to be hedged and controlled against competition so that a nebulous objective, sweepingly labelled "order in the air," might be achieved, Great Britain has taken a long gamble and suffered a diplomatic defeat that will become increasingly embarrassing when the new aviation agreement comes up for the inevitable House of Commons debate. . . .

"... Britain will be able to pay pilots less money, operate with cheaper crews and perhaps add a bit of the London Club atmosphere to her air liners that has paid off on her passenger liners at sea. But these costs are far from basic in airline operations and the big question is: Will British manufacturers be able to produce a dependable, high-performance transport that can be operated on the cost basis equal to the best of the American planes? The question mark is a big one. It will be two years, at least, before even a partial answer can be given. There are grave doubts, but at least the Civil Aviation Ministry seems to be displaying more confidence in the ability of its airlines to meet competition than previous ministers have shown. . . .

"... But a gap has been closed and the end of a rather unpleasant chapter in relations between the two countries has been written, thanks to British willingness to set aside immediate interests for the greater good of the future, and an American willingness to modify, concede and shape, not so much policy but principles. On this basis a diplomatic middle-ground has been found. It was not found in Chicago, where forty-nine other nations were kept waiting while the United States and Great Britain argued over the same ground. . . ."

(ii) Extracts from an article in the *New York Times* and date-lined "Washington, Feb. 27th, (U.P.)," entitled, "Says Britain Tried to Curb Our Flying."

"Great Britain, prior to the recent Bermuda air conference, urged other countries to restrict the freedom of United States international airlines, according to testimony given before the Senate Commerce Committee to-day.

"Defending the new Anglo-American air agreement against sharp attacks by Senators Brewster, of Maine, and McCarran, of Nevada, Administration officials said it ended Britain's hopes for 'artificial controls' on aviation and opened the world's skyways to United States carriers. . . .

"... Mr Baker provoked a heated retort from Senator Brewster when he said that American Airlines and Transcontinental and Western Airlines fully supported the Bermuda agreement but that Pan American Airways was 'in general sympathy' with the original British position that operations should be restricted.

"Mr. Brewster told Mr. Baker he was 'unfamiliar' with the views of those like Pan American, who wanted to 'protect' the United States market.

"Answering a protest by Senator McCarran that the lucrative American air market had been opened to Britain, Messrs. Baker and Pogue said that aviation rights were not a one-way street; we had to give something for the world-wide rights we received in the British Empire.

"'You didn't have to give away everything, did you?' Mr. McCarran asked.

"'That's where we differ,' Mr. Baker replied. 'We think we got a good agreement. You honestly don't.'

"Senator Brewster criticized the right given to Britain to operate a route from London to Santiago, Chile, by way of New York on the ground that it was 'beautifully designed to take American traffic to South America.'

"Mr. Pogue said that Britain, like the United States, wanted its routes to run where traffic was available, but he quoted a section of the Bermuda agreement which he said adequately protected United States airlines against undue encroachment by the British in American markets."

*(Mr. George Baker, by the way, is chief of the U.S. State Department's Transportation Policy Office, and Mr. Welch Pogue is chairman of the Civil Aeronautics Board.)*

(iii) Extracts from the *New York Times* of March 2nd, 1946:

### "AIR PACT CANARD GIVEN TO SENATORS

State Department Replies to Anonymous Document, Disputing its Five Points

WASHINGTON, March 1 (U.P.).

"The State Department accused 'special pleaders' to-day of circulating in executive agencies and in Congress an anonymous and misleading document attacking the Anglo-American aviation pact.

"The Department took the unusual step of submitting the document to the Senate Commerce Committee with a statement contradicting its 'many errors and false assumptions.'

"The committee is holding hearings on the Bermuda accord and some Senators have asked Administration officials questions in line with those raised in the mysterious document, entitled 'Analysis of Result of Bermuda.'

"George Baker, Chief of the State Department's Office of Transportation Policy, said in a statement to the committee that the document was 'largely based upon facts and figures the authenticity of which is not proven.'

"'Furthermore, it is obviously special pleading of a group who consider it to their special interest at this time to oppose any form of bilateral agreement as a means of solving international air transport problems,' he added

"The document contended that Britain obtained more route mileage than the United States, that leased military bases were opened to Britain, that the United States yielded the right of its carriers to set their own fares, that foreign lines with lower costs might fix lower rates and that Britain would use a 'chosen instrument' airline, whereas American carriers would compete against each other. . . .

"... After reading the document, whose author he said he did not know, Mr. Baker submitted a letter from Pan American Airways explaining how the United States policy at Bermuda was 'at variance with our views.'"

The reaction to the Bermuda agreement of the American aviation Press—which is naturally much better informed—was very similar to that of the writer of the first article

## AMERICAN NEWSLETTER

quoted. They feel that Great Britain has had to alter her stand, and that the final agreement is, in effect, a victory for the American point of view. It is also clearly recognised that every settlement of this sort has some *quid pro quo* attached to it and that the British have a right to expect some benefits in return. All of which is fair comment and is as it should be.

If the matter is to be made a political issue, however, we can expect a continued attack on the agreement by those whose views are at variance with American governmental aviation policy and who will certainly seize this chance to further their interests.

* * *

During January, T.W.A.'s European service was delayed in starting because of a strike of its pilots. As a result of this and of other demands by the Air Line Pilots' Association (A.L.P.A.), machinery was set in motion to negotiate the whole question of Pilots' contracts with the air lines. Acting through a Wage Policy Committee of the American Air Transport Association, which Committee was supported by thirteen domestic air lines, Mr. Ralph S. Damon, president of American Airlines, settled the T.W.A. dispute, and it was agreed that their pilots, who were operating DC-4s, would, for the time being, be paid the same rates as ruled for the flying of the four-engined Boeing Stratoliners. Subsequently, the question of whether the Wage Policy Committee could, in fact, be used as a collective-bargaining instrument on behalf of the carriers was raised, and a representative of the A.L.P.A. stated that, if it was, a general strike of air line pilots might result.

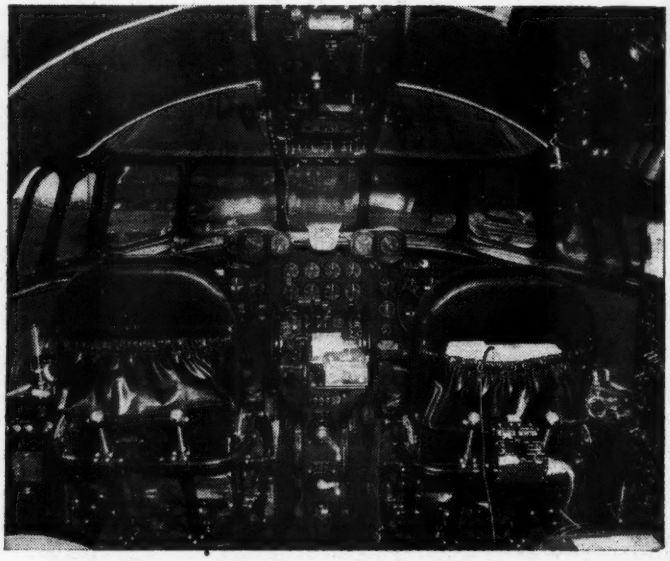
### Pilots' Pay

At the same time the A.L.P.A. announced its proposed salary and contract requirements for Domestic and International operations. These were as follows:—

A maximum annual salary on Domestic operations of $15,000 to $16,000 for pilots of over eight years' experience, and approximately $18,000 for international operations. These figures represent £3,750, £4,000 and £4,500 respectively. Flying time would be reduced from 85 to 75 hours per month. Other benefits sought include personal insurance to be paid for by the company, covering international flying equal to the amount of personal insurance now carried by the individual pilots (this was asked because the pilots' existing policies cease to be effective when flying in international operations); a month's holiday, with pay; reimbursement for expenses arising from the transfer of a pilot from one base station to another; actual reasonable expenses covering suitable meals, lodging, laundry, uniform pressing, transportation, and necessary gratuities while on a trip on company business; and additional expenses when special occasions arose.

The extent of these demands will probably come as a shock to British observers, even when allowance has been made for the difference in exchange rate and the low purchasing power of the dollar. It does seem that the A.L.P.A. threat of a strike raises questions much more serious than those involved in the monetary value of the job itself.

The right to strike has been recognised, and is justly accepted, as a method of obtaining redress where wages are sufficiently low to endanger the security of the worker and his family. The wisdom of striking where no such fundamental security question is involved seems doubtful, and in view of the high salaries already paid and the type of benefits desired, it is scarcely likely that such a move can increase the prestige or dignity of a profession which should have the highest concept of service and tradition in the fulfilment of its work.



**CLOSE QUARTERS: For an aircraft of the size of the Constellation, the control cabin is not particularly roomy, but the controls are laid out with the neat and "permanent" solidity so pleasing in nearly all American types. A flight engineer is carried, and the pilots have only the essential engine controls and instruments for attention.**

This does not mean that pilots have not the right to request higher wages. If they are called upon to do a job requiring more skill, or which entails more danger, or if living costs or conditions alter, then they are obviously justified in making such a demand. The question of whether modern transatlantic flying on four-engined aircraft, with all the latest radio aids and improved weather and ground services, is more, or less, of a skilled or dangerous operation than flying a DC-3 over bad country in wintertime is then a matter for discussion between the companies and the pilots.

But whatever disagreements may arise over these and other problems, no good can come from calling a strike. If the profession of the air line pilot is to retain the prestige and dignity which it deserves, and which will enable its members to ask for, and get, salaries as high as those it now demands, it must not alienate the respect of the public which it is there to serve.

* * *

Production figures of American civil aircraft are always interesting as a comparison, and to show how much greater is their domestic market than ours. According to statistics published in *American Aviation* there are at present 600 aircraft in use by American-owned airlines, and 554 are on order with American manufacturers. Of the latter 295 are twin-engined types and 244 four-engined. By the end of 1947 the estimated number of aircraft in use will have risen to over 1,000. The cost of these new 554 machines is given as over $263,400,000 (£65,850,000), apart from spares.

* * *

News has just been released to the effect that United Air Lines have placed an order for what is described as "a turbine and jet driven" aircraft, with the Glenn Martin Company. This is the first order of its kind to be made public over here, and if Glenn Martin can do what they say they can, and get it into service by 1947, it will certainly be the first turbine-powered aircraft in operation on an airline. Details of the machine are rather scanty at the moment, but it is reported that the power units will be General Electric turbine-propeller T.G. 100s and the cruising speed is expected to be 380 to 390 m.p.h. Whether the aircraft itself is to be a modified 303 (which is the larger and pressurized version of their 202), or whether it is a new design altogether, is not known.

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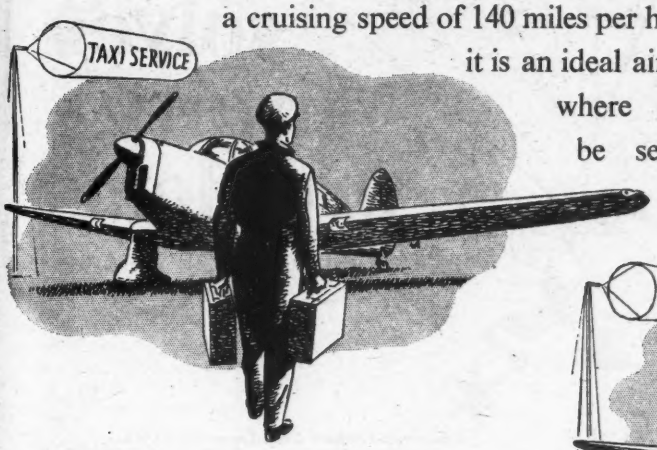


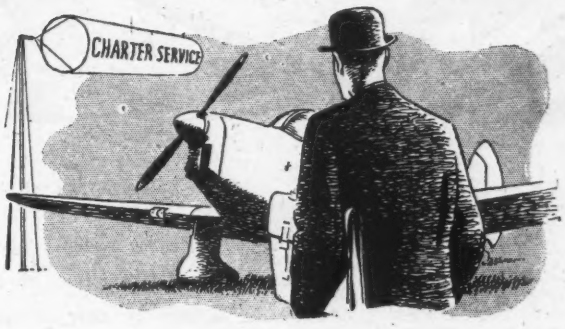


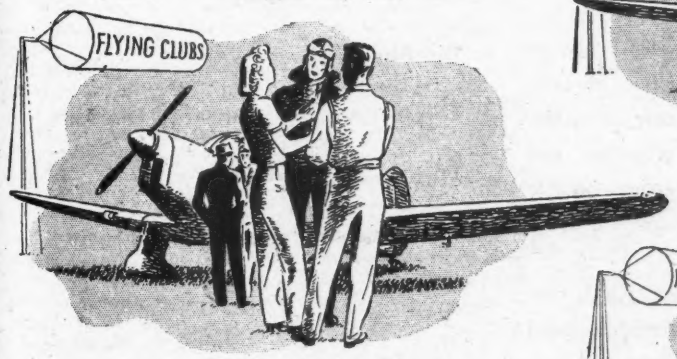


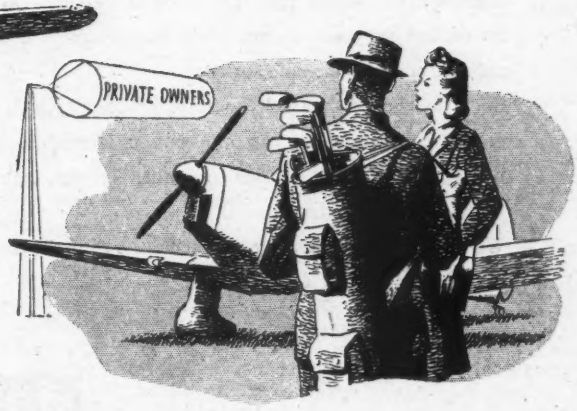


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# The Air Estimates

## *Size of Permanent Post-war Air Force Not Yet Determined : New Aircraft, Supplies, Research and Development Not Included*

WHEN he introduced the Air Estimates in the House of Commons on March 12th, Mr. John Strachey, the Under-Secretary of State for Air stressed that the size of the permanent post-war Air Force had not yet been determined. The only decision that had been made was that the maximum strength by the end of this year was to be 305,000. He added later, that any attempt by any Government to decide the character, size and structure of the permanent post-war Air Force was quite certain to be wrong because the technical and political fundamental data did not exist. The figure of 305,000 was the figure which was thought to be adequate to meet our commitments as at 1947, bearing in mind that, in the present state of the country, the Royal Air Force could not have a man more than necessary.

Mr. Strachey's clear statement, which was praised by speakers in the subsequent debate, was, to use his own words, of a "transitional kind," and consequently contained only such figures of finance as he considered of outstanding importance. The Estimates themselves, he said, were transitional, but fuller details would be introduced for debate in April.

There were three essential parts to the Under-Secretary's statement. First, in order to complete the picture of the R.A.F.'s war effort, which had been given in previous years by his predecessors, he mentioned some of the R.A.F.'s work in the concluding months of the war; secondly, he touched on various aspects of the expenditure for the coming year; and thirdly, he made some observations about the future functions, character and size of the Service, although he emphasized that these were very tentative.

| | Estimates 1946 |
|---|---|
| I.—STRENGTH: | Number |
| Maximum Number of Officers and Airmen to be maintained for Air Force Service, excluding those serving in India on the Indian Establishment | 760,000* |
| | £ |
| II.—EFFECTIVE SERVICES: | (Net totals) |
| Pay, etc., of the Air Force | 176,500,000 |
| Quartering, Non-Technical Supplies and Transportation | 20,250,000 |
| Technical Supplies and Services | 16,600,000 |
| Works, Buildings and Lands | 36,250,000 |
| Medical Services | 410,000 |
| Educational Services | 720,000 |
| Reserve and Auxiliary Forces | 350,000 |
| Civil Aviation | — |
| Meteorological and Miscellaneous Effective Services | 4,070,000 |
| Air Ministry | 3,230,000 |
| Total Effective Services | £252,380,000 |
| III.—NON-EFFECTIVE SERVICES: | |
| Half-Pay, Pensions and other Non-Effective Services | 3,120,000 |
| Total Effective and Non-Effective Services | £255,500,000 |

** The number to be voted is the maximum which may be maintained at any time during the year and includes personnel on release leave. For 1946, the number to be maintained will be at its highest in April; thereafter and throughout the year, there will be a considerable decline in the number maintained.*

In the first part of his speech, Mr. Strachey mentioned briefly some of the actions in which the R.A.F. had been engaged during the last few months of the war, such as coverage for the 21st Army, the final killing of U-boats, and supply operations in Burma. He dealt in greater detail, however, with Bomber Command's offensive, on the score that it was of high national concern to ask whether these resources were really well employed in the most effective manner. Mr. Strachey produced proof that Bomber Command was so employed by showing, in the words of high-ranking German officials, what had been the effect of that offensive on the two types of complementary objective which had been attacked—German transportation systems and the German synthetic oil industry. He gave a reminder, however, that the 8th and 15th U.S. Air Forces had played an equally important part in the success of the bomber effort.

The evidence of Dr. Albrecht Speer, Reichminister for Armaments and War Productions, showed that, in the summer of 1944, concentrated day and night attacks on the Ruhr communications system produced serious anxiety about future developments since essential supplies became bottled up in the Ruhr. It also showed that similar transport difficulties caused the breakdown of the Ardennes offensive.

The effects on the German oil industry from May, 1944, to May, 1945, continued Mr. Strachey, were clearly shown in five "Top Secret" reports from Speer to Hitler which were in our possession. (The extracts from these documents are given in full on page 298 in view of their historic interest.) In interrogation after the war, Speer said that the shortage of liquid fuel in the *Luftwaffe* became insupportable as from September, 1944, the allocation being cut down from the requisite 180 thousand tons a month to a mere 30 thousand tons. Similarly, lack of fuel for the army became catastrophic at the time of the winter offensive of December, 1944, and this was subsequently responsible for the rapid collapse of the German defensive front against the Russian break-out from the Baranovo bridgehead.

Mr. Strachey also quoted Field Marshal Milch, head of the *Luftwaffe*, as saying, "If the synthetic oil plants had been attacked six months earlier, Germany would have been defeated about six months sooner." He added that it had not been possible to attack these objectives on the requisite scale at an earlier date, but the evidence he had given showed that the sacrifice of life, and all the heroism which was devoted to the strategic bomber offensive was fully justified.

Passing on to the part to be played by the R.A.F. in national life today, the Under-Secretary said that the first contribution was to carry through a speedy, but controlled and orderly demobilisation. The strength of the R.A.F. on VE-day was 1,110,000. By December 31st, 365,000 had been released, and by June 30th next, another 377,000 will have been released—a total of 742,000 within ten months of the end of the war with Japan. By the end of this year, the R.A.F. would be reduced to a strength of 305,000. These figures included men and women. Mr. Strachey maintained that the demobilisation scheme was standing the test well. An unevenness between trade and trade, and Service and Service, was inevitable, but no one could get through a period of demobilisation after a great war without some trouble. He denied that there had been any speed-up in the rate of demobilisation as a result of the recent troubles at stations in India. The men there had believed that the release rate was to be far slower than was actually the case, and the remedy had been to announce the programme of

releases five months ahead instead of three, as previously. The second contribution to the post-war clearing-up process was the disposal of surpluses, said Mr. Strachey. He gave an assurance that stores were being declared surplus as fast as possible. Stores occupying 6,000,000 sq ft of space had been dealt with and other items included 13,000 vehicles with another 17,000 to follow, 100,000 tons of explosives, with a further 300,000 tons to follow.

## THE AIR ESTIMATES CONTINUED

Everything was being done to return to agricultural use the cultivable land at present occupied by airfields, continued Mr. Strachey. In addition to the 50,000 acres released last year, 100 airfields and parts of 50 more had been released since the New Year, but he warned members not to place too great a hope on the contribution this represented to food growing, for, of the 31,000,000 acres of cultivable or pasture land in the United Kingdom, the Air Ministry, at the peak period, only held 240,000 acres, or less than 1 per cent., of which one-third had already been released.

Some 6½ million sq ft of hutting and other accommodation on airfields was being used to accommodate soldiers, sailors, prisoners of war and stores, thus permitting a great deal of derequisitioning. So far, two-thirds of the 6,000 non-industrial properties held had been derequisitioned, and another 1,000 would have gone by the end of June, leaving only 500. Some 9,000,000 sq ft of factory space had been held, of which 6,500,000 sq ft would have been evacuated by the end of June, and practically all the remainder by the end of the year.

Dealing with the estimates themselves, Mr. Strachey pointed out that the maximum number of R.A.F. personnel to be considered was 760,000, but that this would drop to 305,000 by the end of the year in accordance with the demobilization figures already quoted. Therefore, the £176,500,000 for pay, etc., was not the cost of maintaining the maximum strength, but only of the falling average throughout the year.

One important point about this year's estimates was the terminal charges which were peculiar to demobilization year, and amounted in all to £80,000,000, i.e., £31,000,000 for leave pay, £25,000,000 for war gratuities, and £11,000,000 for post-war credits. The real provision for the R.A.F. was, therefore, not £255,500,000, but only £175,500,000. It also afforded an explanation of why financial relief, as the result of demobilization, would not be felt until next year.

Another important point about the estimates was that they did not include the cost of aircraft and supplies generally. These figures, together with the cost of development and research, were borne on the Vote for the Ministry of Supply.

### Centralized Supply

This financial arrangement was part of the new system of centralising supply for the Armed Forces, which had the important advantage of enabling the Government to foster and safeguard more effectively the industrial war potential of the country. There might be a danger, however, that user Departments might lose touch with the makers of weapons and supplies, and so, during wartime, a member of the Air Council acting as Controller of Research and Development with a strong staff of R.A.F. officers, formed an integral part of the Ministry of Aircraft Production. This system was being perpetuated with very little alteration. The senior aircraft post in the new Ministry of Supply would be that of Controller of Aircraft Supplies, and it was filled to-day by Air Marshal Sir W. A. Coryton, who remained a member of the Air Council. The Air Ministry would also be directly represented on the Supply Council which was formed under the chairmanship of the Minister of Supply.

Mr. Strachey said that in 1946 we were at the beginning of a new aviation revolution which affected combat, transport and civil aircraft alike. It was based on a new method of propulsion, the gas turbine, which, in one form or another, was superseding the piston engine altogether, whether in the single-seater fighter or in the 100-seater air liner. Tremendous new problems had been set for airframe designers, including that of the approach of aircraft speeds to the speed of sound. This was not the only startling development, however; the possibility of guided aircraft, the problem set for aircraft by the super-fast submarine, and the release of atomic energy were all items in a series of startling scientific developments. The Under-Secretary emphasised that, so far as gas turbines were concerned, this country once again had undoubted leadership. No one was yet producing gas turbines as good as ours, but we were not enjoying all the advantages we ought, because concentration on the prosecution of war had precluded development of large airframes suitable for transport and civil use. If we pressed on with those forms of technical development in which we had not caught up with our own development in the engine field, we could obtain incalculable advantages, affecting all types of aircraft.

The new arrangement for research recognised this fact, and centralization in the Ministry of Supply enabled the effort to be applied to the whole aviation field. Thus, in the Vote for the Ministry of Supply there was a sum of £28,000,000 to be devoted to aviation research, a very small figure compared with the benefits likely to be derived from it. Mr. Strachey begged that if there was to be economizing, it should not be at the expense of research and development. Our lead should not make us complacent, for, if we slackened our efforts, the friendly rivalry of the United States would rapidly overtake us.

In the final part of his speech, Mr. Strachey stressed that the future functions of the R.A.F. were bound to depend on two recent events, the release of atomic energy

### THE BOMBER COMMAND OFFENSIVE

***Dr. Albert Speer as quoted by John Strachey, Under-Secretary of State for Air.***

* * *

*On June 30th, 1944:* "The enemy's attacks on the hydrogenation works and refineries were intensified during June. If we do not succeed in protecting the hydrogenation works and refineries better than formerly, then, in September of this year (*i.e.*, 1944) an impossible situation in the fuel supply for the Wehrmacht and country will arise."

* * *

*On July 28th, 1944:* "The attacks on the synthetic-oil plants and refineries in July had the most dire consequences. It was possible for the enemy, in most cases, to destroy the plants effectively shortly after work in them had been resumed.

* * *

*On August 30th, 1944:* "If the attacks on the oil industry continue in the same strength and with the same precision in September as in August, the last stocks will be consumed."

* * *

*On October 5th, 1944:* Speer said that he was able to get produced only 9,000 tons out of a possible 22,000 tons of aviation spirit.

* * *

*On January 19th, 1945:* "Since January 13th, a new series of heavy attacks have been made on the mineral oil industry, which have, up till now, led to the elimination of the large hydrogenation plants . . . it has now been determined that the attacks which take place so often at night now, are considerably more effective than daylight attacks, since heavier bombs are used and an extraordinary accuracy in attaining the target is reported."

* * *

*Asked in interrogation after the war:* "Do you believe that strategic bombing alone could have brought about the surrender of Germany?" Speer replied: "Yes; the attacks on the synthetic oil industry would have sufficed, without the impact of purely military events, to render Germany defenceless."

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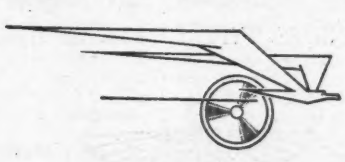

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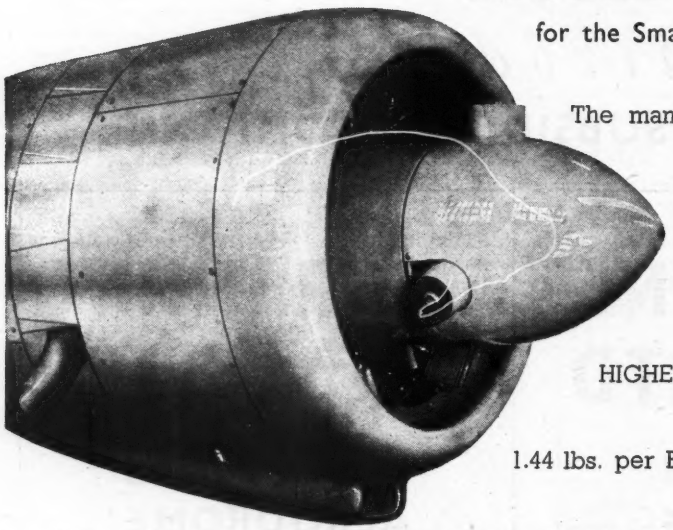

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and the foundation of the United Nations organization. The subject of defence against attack by atomic bomb had the constant attention of the Air Council and its technical advisers. It was odious even to have to think of the inexpressible ghastly consequences of war to-day, but we had to think of them just so long as international anarchy persisted. The real safety of all peoples of all countries lay in the development by the United Nations organization of a world force capable, in the last resort, of enforcing the will of the United Nations on the world. Undoubtedly, air forces were the most suitable instrument for this purpose, and the R.A.F. must be prepared to make a worthy contribution as and when such a force developed.

Dealing with the post-war pay and allowance codes, Mr. Strachey pointed out that these had now been fixed for all ranks. He added that he was now able to announce a very small reduction in the length of overseas tours of duty. Beginning April 1st, the tour for single men would be reduced from 3½ to 3 years, bringing them on to the same level as married men. The scheme would take until October 1st to complete, and after that it was hoped to go further. Mr. Strachey said: "We do assure men who are thinking of making the R.A.F. their career that the terribly long overseas tours which have been the rule during the war are not for one moment intended to be the rule in the post-war Air Force.

Passing to the A.T.C., he said that he knew the sense of frustration which had sometimes been felt by the Corps, but a good deal had been decided, and he hoped very soon to give them their exact place in the future organization of the R.A.F. Provisionally, their strength had been fixed at 75,000, and this would enable all cadets of satisfactory standard to be accepted into the R.A.F.

So far as the W.A.A.F. was concerned, it was the opinion of the Air Council that there were many Service jobs which could be done better by women than by men, and that an essential operational factor of the R.A.F. would be missing if there was no W.A.A.F. However, an announcement from all three Services on the future of the women's Services must be awaited.

Mr. Strachey completed his speech with a general tribute to the R.A.F., emphasising the value to this country of the R.A.F.'s reputation and fame. "Let us not forget," he said, "what all the world remembers: that the Royal Air Force stood, not only between us and slavery, but between all peoples and slavery."

## THE AIR ESTIMATES (CONTINUED)

### The Debate

During the debate which followed, many former R.A.F. officers added their views. The first speaker was Group Capt. George Ward, who went straight to the problem of Reserves. He expressed the hope that the figure of only £350,000 allotted to the auxiliaries and reserves was not an indication of the importance attached by the Government to these forces, and suggested that, before the war, the dozen or so squadrons of the Auxiliary Air Force were the nation's best bargain. Their contribution to our air strength was made at a fraction of the cost of regular squadrons. A feature of the auxiliary squadrons was the excellence of their spirit and this squadron spirit should be fostered. The Auxiliary Air Force should form the basis of all our reserves and should have the Volunteer Reserve as a second line reserve.

He asked that the Reserve Command should be set up again as soon as possible. Group Capt. Ward considered that although "centralized maintenance" had been economical in man-power, the divorce of maintenance from the squadron had been a main cause of deterioration in discipline because it had removed from the shoulders of the G.D. officer the bulk of his responsibilities. He suggested that the duties performed during the war by the Glider Pilot Regiment should be handed over to the R.A.F. Regiment.

Group Capt. Max Aitken, in a short and pointed speech, asked for an Empire Air Force. Planning and training should be on Empire basis as during the war. He also insisted that this Empire force should be capable of powerful attack, for attack was the greatest deterrent to war. He suggested cutting the estimates and taking man-power from the Services, if necessary, for atom bomb development.

Mr. Tom Driberg thought that many men serving overseas lacked adequate knowledge of demobilization facts. He asked for more amenities in such places as the Persian Gulf, and also wanted to see the end of anomalies in conditions and pay which arose when R.A.F. and B.O.A.C. personnel worked together on the same station.

Air Comdre. Harvey pleaded for a strong auxiliary Air Force, which should extend to the Colonies. He also recommended that A.A. Command should be taken over by the R.A.F. Group Capt. Wilcock, too, supported the pleas for the Reserve. He asked for a reduction in the number of R.A.F. trades and recommended that maintenance should be undertaken by civil aviation or in civilian factories. He wondered whether the W.A.A.F. were necessary in peacetime, and hoped that they would only be employed at home, if they were. Overseas we needed only a hard-hitting mobile force.

Wing Cdr. Millington considered that Mr. Strachey had referred too casually to the work and the losses of Bomber Command, and suggested that there was a feeling amongst Bomber Command personnel that Sir Arthur Harris and the Command had been affronted by the absence of his name from the New Year's Honours list.

### The Auxiliary Forces

Mr. Quintin Hogg wanted to know more about the size and shape of the organization of the Air Force and how it was to fit into the general plan of imperial defence; Wing Cdr. Robinson mentioned that the first rumblings of complaint from officers about their new rates of pay and allowances were beginning to be heard; while Sqn. Ldr. Sir Gifford Fox seemed to think that lack of discipline in the R.A.F. was entirely the fault of station commanders.

A number of other speakers took part in the debate, including Mr. Harold Macmillan, who, emphasizing that the estimates contained no sum for aircraft and stores, said that he was not altogether happy about a scheme which relied on supply by another Department. He added that the Navy, who since the time of Pepys had always had a pretty good idea how to travel permanently first class, had never agreed to any inter-service arrangements except for such stores as were of no particular interest, such as gym shoes.

Replying to the debate, Mr. Strachey assured Members that their enthusiasm for the auxiliary forces was shared, and that he would have liked to announce the setting up of a Reserve Command. An announcement would be made in weeks rather than months, but it seemed that many well-informed members had a good idea of how the auxiliary forces would fit into the post-war Air Force; the estimate of a score of auxiliary squadrons might not be far wrong. He considered that the extension of the auxiliary squadron scheme to the Colonies and Dominions was an excellent one well worth examination. Referring to the question of "centralized maintenance," he agreed that maintenance in the squadron had a great psychological advantage and said that the reversion to this system was gradually being made.

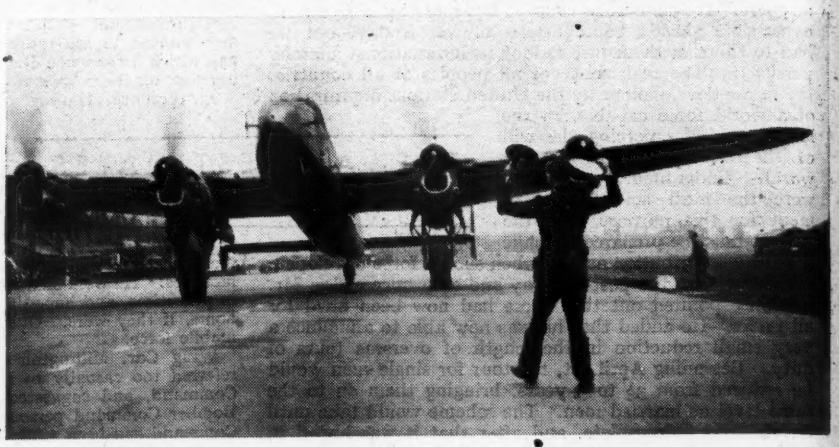
Mr. Strachey agreed that the administration of the Service was indeed a problem, but the employment of "Admin" officers would, to a great extent, cease, and administration, which was really leadership, would be carried out by the G.D. officer. R.A.F. and B.O.A.C. anomalies in pay would be solved by the civil airlines being taken over by the appropriate civil corporations; in fact, the scheduled services of Transport Command were already being taken over by civil operators and he hoped that the process would be virtually complete by the end of June.

Referring to Wing Cdr. Millington's remarks about Sir Arthur Harris and Bomber Command, Mr. Strachey said that he had failed utterly in the main purpose of that part of his speech if he had not emphasized sufficiently the tremendous service to the country of that Command, and the sacrifices it had made.

With regard to the A.T.C., he did not think that the picture was as gloomy as members made out, repeating that the target of 75,000 should make it possible to accept into the R.A.F. every cadet who reached a satisfactory standard. He emphasized that the decisions on the strength of the R.A.F. were provisional and for the immediate future, and that a long-term decision would be reserved until the situation became far clearer than it was to-day.

# England-New Zealand Records

## *R.A.F. Lancastrian Completes Return Trip in 6½ Days, and Brings a Hitch-hiker*



**HOME AGAIN: The Transport Command Lancastrian, VM726, taxies on to the tarmac at Northolt (note the "batsman") at the end of its 6½ days record flight to New Zealand and back.**

THE Lancastrian of R.A.F. Transport Command which flew from Northolt to Ohakea, the airport for Wellington, New Zealand, and back in approximately 6½ days set up an elapsed time record which virtually made air history—New Zealand and back within the week, and Australia-England within two days.

A second Lancastrian, VM727, which left Northolt 24 hours after VM726, reached New Zealand in an even shorter time, but was prevented by bad flying weather from completing the return flight to schedule. When almost home it had to turn back and spend the night at Bordeaux instead of landing at St. Mawgan, Cornwall.

The first of the two aircraft to complete the trip (VM726) touched down at Northolt on Tuesday, March 12th at 2.46 p.m.—only 16 minutes after the ETA of 2.30 p.m. marked on the flight plan and a very creditable show on a flight of 12,830 miles. Total elapsed time from take-off to touch-down at Northolt was 6 days, 13 hr 15 min.

### Handsome Margin

As reported in last week's issue, this Lancastrian covered the outward flight in an overall time of 62 hr 5 min and beat the previous record by the handsome margin of 22 hours. Having taken off from Ohakea at 1.18 a.m. G.M.T., it made a slightly faster homeward flight in 61 hr 28 min. The complete trip of 25,660 miles was covered in 111 hr 46 min flying time, which represents an average speed, while airborne, of about 230 m.p.h. Thus the merit of the performance lies not so much in the flying-time average as in the remarkably short overall time achieved by having two complete crews to take turn and turn about, and in spending as little time on the ground as was reasonably possible.

**CAPTAINS COURAGEOUS: Sqn. Ldr. John Adams, D.F.C., A.F.C., skipper of the VM726, and (right) Flt. Lt. W. R. Birdling, D.F.C., captain of the second crew, look deservedly pleased with life.**

The return route was the same as that of the outward flight, with stops at the same five places, namely, Melbourne, Guildford (near Perth), Cocos Islands, Negombo (Ceylon) and Shaibah (head of the Persian Gulf). Only 6 hr 43 min was spent in refuelling at these halts, while the crews' rest period in New Zealand was just under 48 hr.

Judging from the New Zealand captain's remarks after the landing at Northolt, the return trip was more or less uneventful. There was, however, one story told by Sqn. Ldr. J. Adams which added a touch of the romantic to an otherwise prosaic, if decidedly rapid, training flight laid on primarily for the benefit of the crews who belong to a V.I.P. flight specializing in long-range work.

### The Lucky Man

When they reached Ceylon an Australian ex-air gunner came up and asked the captain if they could give him a lift to England. He had been unable to get on to a ship, so had decided to hitch-hike from Australia to England and had managed to get a ride in a Liberator as far as Ceylon. He had, he explained, a wedding date with his fiancé in Hove—an occasion that had been delayed a year or two owing to his having had to bale out over enemy territory one day. There was room for him, and his papers were in order, so he came along.

The second Lancastrian, VM727, improved on her sister ship's time by reaching New Zealand in 60 hr 45 min. This aircraft was captained by Sqn. Ldr. A. Bradshaw, also a New Zealander; it followed the same route and refuelled at the same points. Curiously enough, although the overall time for the outward flight taken by the VM727 was 1 hr 20 min less than the VM726's time, its actual flying time was 1 hr 2 min longer.

Bad luck in the matter of flying weather, however, overtook the VM727 when she was at the very end of her return flight and within sight of duplicating her partner's record of completing the round trip well within the week. Having been compelled, as stated above, to turn back from her intended landing at St. Mawgan and put down for the night at Bordeaux, her skipper took off from the French airfield on the morning of March 14th and touched down at Bassingbourn, Herts, at 11.57 a.m. Even so, the time for the out-and-back flight was no more than 7 days, 10 hr 20 min.

Of the four aircrews manning the two aircraft the VM727's first crew were all New Zealanders, the other three being British and New Zealand personnel.

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# CORRESPONDENCE

*The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers not necessarily for publication, must in all cases accompany letters.*

## LONG-DISTANCE RECORD

### *Lancaster v. Wellington Consumption*

I WAS very interested in R. G. Lofting's letter (*Flight*, Feb. 28th) even though he disagreed with me on several points concerning the fuel consumptions of the Lancaster and the Wellington.

Now first about the Lancaster.

The normal fuel capacity of the Lancaster is 2,160 gallons. The additional fuel required (3,740 gallons) could be carried in tanks fitted into the bomb bay (length 33ft).

Many Lancaster Mk Is (span 102ft) during the war often operated at a maximum a.u.w. of 68,000 lb. Even when overloaded to 73,000 lb the wing loading on take-off would be 56 lb/sq ft as compared with the 80 lb/sq ft of the record-breaking Boeing B-29 Superfortress.

I estimated the cruising speed (190 m.p.h.) of the Lancaster on the power-loading of 14.4 lb/h.p., which I think is quite feasible in view of the fact that the B-29 achieved an average cruising speed of 234 m.p.h. on a power loading of 16 lb/h.p.

From information available I have calculated the fuel consumption of the Merlin 20 Series at 44 gal/hr (60 per cent power). In the case of the Lancaster, I have based my figures on the Merlins operating at 40 per cent power, hence the fuel consumption figure of 29 gal/hr.

Now I turn to the Wellington I. I gave the fuel consumption per engine as 24 gal/hr. May I point out to Mr. Lofting that the Vickers Wellesleys, which captured the long-distance record in 1938, achieved this with similar Pegasus engines. The fuel consumption of these engines on this occasion was slightly more than 20 gal/hr on a loaded weight of 19,000 lb.

If the war had not intervened the Air Ministry had plans laid down for a modified Wellington to improve upon the performance of the Wellesleys (7,158 miles—Ismailia to Darwin) by flying from England to Australia—a distance of some 10,000 miles.

In conclusion I would like to thank the editorial staff of *Flight* for their excellent data table on new British civil aircraft (Feb. 28th). JOHN LAWSON COVERDALE.

## LET US BE HONEST

### *Is There Too Much Publicity Consciousness?*

BY all means, "let us be honest."

But I am shocked that a journal such as *Flight* should suggest that there is "too much publicity consciousness." Furthermore, that "Indicator," whom I respect for his writings, should say—and not suffer sub-editorial erasion—that "this country has a growing weakness for the transatlantic habit of ballyhoo," makes me wish that he would stick to his last and leave advertising and publicity alone. He adds that "public relations experts are only able to stress the obvious"—which may be a good lesson for others as well—but suggests that they are "bullied by publicity-concious directors." Ask an advertising manager what he thinks of that.

"Indicator" also, having duly slated us for being too American air-transport conscious, proceeds to detail "all kinds of dazzling projects from the other side" himself. What "President" can be bullying *him*?

I have had the opportunity of meeting many American officers, A.A.F. and others, and the result of their much-condemned publicity is that they just do not believe that the Spitfire was faster than the Mustang, or the Meteor than the Shooting Star. It may have no effect on their technicians, but it does give the rank and file self-confidence and morale. "Indicator" should not confuse the ballyhoo of politics, in which "the public *can* be indefinitely fooled, and even, perhaps, mild dishonesty *may*, after all, be the best policy," with honest, instructive, technical advertising, such as sometimes appears in your journal, and always—of course—in the editorial columns.

What I do take exception to in British publicity for British aviation generally is in the fact that the aircraft automatically receives the bouquets, whereas the engine *on which it depends for flight* is hardly ever mentioned, certainly not as news. *Starlights* come and go; Meteors, Fireflies, Spitefuls and even Yorks and Tudors put up their records for Britain; but the newspaper stories and broadcast news bulletins never mention the heart of these aircraft—the engines—which, after all, are British too.

Let "Indicator" preach that lesson, to counter, for example, the heresy—admittedly extreme—that Packard subcontracted Merlins to Rolls-Royce. The Tudor II's first test flight has just been announced, but the engines might have been American as far as the Press was concerned. Why not let us be honest? "ALATUS."

["Indicator's" comments on the letter are: "It only shows how dangerously words can be misconstrued. By all means let us shout our British odds as loudly as we can—but not to the extent of distorting facts or even of mis-stating them. We don't need to do either. As for my details of 'all kinds of dazzling projects from the other side'—surely skittles must first be put up before they can be knocked down.]

## TRICYCLE TECHNIQUE

### *A Correspondent Disagrees and Gives Some More Facts About the DB-7*

"INDICATOR'S" passion for accuracy seems to be waning. If he had difficulty with the brakes on the Havoc I, Boston II or Boston III he should have placed his feet lightly on the pedals and pressed gently, not—as he appeared to do—tried to shove his foot through the cockpit flooring. If he had used his engines a little to help he would not have needed brakes at all except to stop.

Not many people appreciate that there was a difference between the three DB-7 types. Boston IIs, apart from the 12-gun version of 85 Squadron, were used mainly as "Turbanlites"—their main claim to a place in history being, in 1942, the destruction of one Stirling. Havoc Is, including those intended for the French, with their peculiar instruments (I believe we took off with 13 "Pezas" (Pz) and cruised at 8) were used by No. 23 Squadron for intruder work. Boston IIIs gradually replaced these aircraft for this work.

But the insult, dear "Indicator," is this: ". . . the Havoc never got into its stride as a night-fighter . . ." Sheer nonsense! From June, 1941, to June, 1942, Havocs flew, on intruder work, 40 sorties for 1 enemy aircraft destroyed. The Beaufighter figures were in the region of 138 sorties for one destroyed. We also dropped bombs on different things; do you know that 23 Squadron really got train-busting going? Havoc Is gave rich dividends.

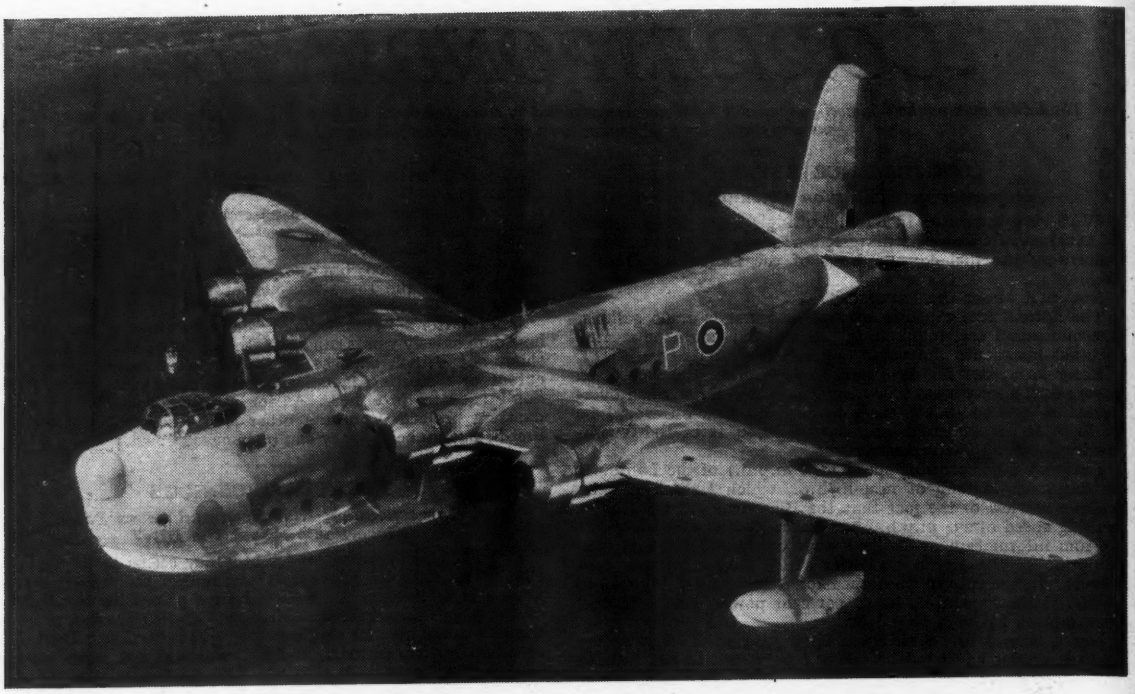
I disagree with "Indicator" about the take-off. There is not any need to hold it down to 140 and then to yank it up in the air—just ease the stick back to bring the nose-wheel up and she'll fly off at about 115. I have tried hard to recall a time when any alteration of trim was necessary on raising the undercarriage—and as for sinking after take-off. . . .

Havoc Is were ducky affairs and at night I would fly on the Pioneer compass in my observer's compartment; we also handed each other things through the hole provided. Although the Boston III did not have this hole, we had a signal light and I could write rude notes and send them to my rear-gunner by the wire provided.

I can recall no Boston III which was not fitted with an emergency device to drop the undercarriage.

Both Havoc I and Boston III were beautiful to handle (I never flew a Boston II). But a Boston III, with a belly-set of four 20 mm. cannons and a long-range fuselage tank, was not quite so nice. They were officially named "Intruder II" and there was a proviso that a Rate One turn must not be exceeded under 170 A.S.I. R. E. WAKEFORD (W/O.).

["Indicator" replies: "I accept the reproof concerning the Havoc's record as a night-fighter—though it all depends on the meaning of the expression 'getting into its stride.' As for braking difficulties, these were clearly described in the article as being applicable only 'in our early unfamiliarity with American-type toe-brakes!' Either W/O. Wakeford had wonderful foot-control or his memory is poor. I didn't say anything about 'holding it down to 140' on the take-off and the aircraft certainly *had* a sinking tendency—but maybe this had nothing to do with the undercarriage movement. The early DB-7s, at least, had no final emergency device for undercarriage lowering. Perhaps I didn't sufficiently praise the type—it was very nice indeed as a flying machine, whatever its virtues or defects as a bomber and fighter."]



**MILITARY AND CIVIL : The first prototype Short Shetland flying-boat, which was unfortunately destroyed by fire earlier this year. Construction of a second prototype is well advanced.**

# SERVICE AVIATION

## *Royal Air Force and Naval Air Arm News and Announcements*

### *Appointments*

AIR VICE-MARSHAL A. C. COLLIER, C.B., C.B.E., to be Air Officer Commanding, Headquarters, No. 3, Group, Bomber Command.

Air Vice-Marshal H. S. P. WALMSLEY, C.B., C.B.E., M.C., D.F.C., to be Air Officer, Transport Command, South East Asia.

Air Vice-Marshal C. B. COOKE, C.B., C.B.E., to be Director-General of Servicing and Maintenance, Air Ministry.

Air Vice-Marshal T. A. WARNE - BROWNE, C.B.E., D.S.C., to be Air Officer Commanding, No. 43 Group, Maintenance Command.

Air Vice-Marshal Collier has been Deputy A.O.C.-in-C., Transport Command, since November, 1943. From April, 1942, he was A.O.A. at Air H.Q., India, after having been Director of Intelligence (Security) at the Air Ministry. In 1941 he accompanied the military mission to the U.S.S.R.

At the outbreak of war he was at the Air Ministry as Deputy Director of Plans, and in January, 1940, was appointed Senior Air Staff Officer of the A.A.S.F. Subsequently he became Director of Allied Air Co-Operation.

He was awarded the C.B.E. in January, 1941 and the C.B. in 1943.

In his new post Air Vice-Marshal Walmsley will be adviser to the Allied Air C.-in-C. on transport matters, with responsibility for co-ordinating the transport groups in A.C.S.E.A. He has been A.O.C. No. 4 (Bomber) Group since May, 1945. In Feb., 1944, he was appointed S.A.S.O., H.Q. Bomber Command, having previously been A.O.C. of No. 6 Group.

**Sqn. Ldr. L. H. Trent, D.F.C., who was awarded the V.C. for an attack on an Amsterdam power station in May, 1943. His citation appeared in *Flight*, of March 7th, 1946.**

Air Vice-Marshal Cooke has been A.O.C. No. 43 Group, Maintenance Command, since June, 1945. He was previously Chief Maintenance Staff Officer, H.Q. M.A.A.F. to which position he went after six months as Deputy Director of Training, Air Ministry.

Previous to this new appointment Air Vice-Marshal Warne-Browne was Senior Engineer Staff Officer at H.Q. Coastal Command. In September, 1940, he was appointed to H.Q. Technical Training Command for Air Staff engineering duties. For three years previously he was on engineering duties at R.A.F. Station, Gosport.

### *Roll of Honour*

*Casualty Communiqué No. 573.*

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 250 are second entries giving later information of casualties published in earlier lists.

### *Royal Air Force*

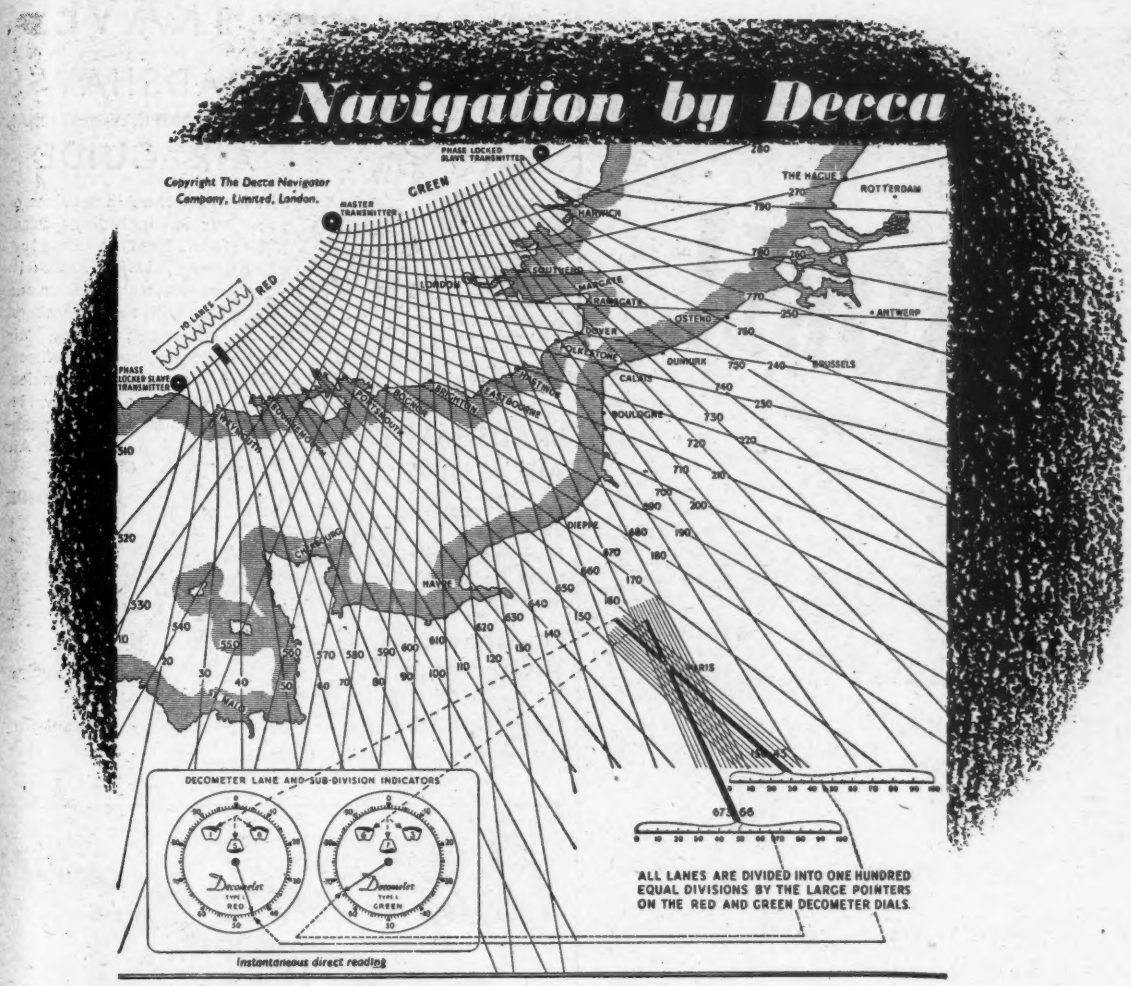
KILLED IN ACTION.—Flt. Sgt. G. T. Watkins.

MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. W. T. Adams; Sgt. I. K. Aldridge; Flt. Sgt. E. W. Barker; F/O. A. H. Duff; F/O. B. J. C. Griffiths; Act. Flt. Lt. F. T. Holliman; F/O. J. A. Merriman; F/O. G. A. Mombrun; F/O. J. W. B. Simon; Flt. Sgt. D. Tuffnell.

MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. H. Davidson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. D. E. Firman; Act. Flt. Lt. B. J. Hines; Act. W/O. A. J. Marrable; Flt. Lt. J. B. Shillitoe.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. K. E. C. Adams; Act. F/O. N. F. Aldred; Flt. Lt. J. N. Andrews; Sgt. A. Archer; Sgt. V. J. Badger; Sgt. F. R. W. Baker; Flt. Lt. H. A. B. Baker; Sgt. C. A Balser; Act. Sqn. Ldr. C. R. Barrett, D.F.C.; Flt. Sgt. R. A. Barringer; P/O. C. A. Bartlett; W/O. D. M. Beck; Act. F/O. W. Begg; F/O. J. Bell, D.F.C.; Sgt. J. B. Bell; Sgt. M. Benjamin; P/O. D. G. Benning; Sgt. G. H. Benson; Sgt. T. H. Billington; P/O. F. E. Blackman; Sgt. E. D. Bone; F/O. J. T. Boundy, D.F.C.; Sgt. F. D. Boyle; Flt. Sgt. R. Boyle; Act. F/O. G.

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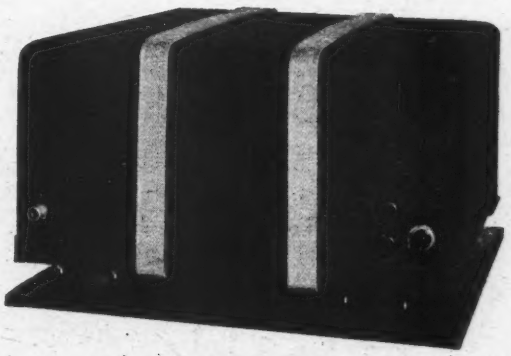

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PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. A. J. Berry; Act. F/O. J. Grayshan; F/O. J. M. Shortile; Sgt. E. T. West.

PREVIOUSLY REPORTED MISSING, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Lt. L. G. Fowler, D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—F/O. J. A. Law, D.F.C.; Flt. Sgt. D. E. Olden; Sgt. P. West.

MISSING.—Flt. Sgt S. S. Aarons; Sgt. S. Alexander; Flt. Sgt. F. W. Gonsalves; Flt. Sgt. E. F. Hughes; Flt. Sgt. J. Jobson; F/O. E. A. Penfold; P/O. W. F. M. Skipworth; Flt. Sgt. G. J. H. Snewing; Flt. Sgt. J. Stewart.

KILLED ON ACTIVE SERVICE.—L.A/C. A. Cafferty; L.A/C. A. D. A. Campbell; Act. Flt. Lt. J. M. Darlow; Flt. Sgt. G. E. Gazzard; Flt. Lt. G. C. D. Green; A/C.2 S. S. Hadden; W/O. J. A. Jeanes; L.A/C. J. J. Jones; Act. Flt. Lt. A. E. Leman; Wing Cdr. A. D. J. Lovell, D.S.O., D.F.C.; W/O. D. Mitchell; Flt. Lt. R. J. Philip, D.F.C.; F/O. R. A. Sargeant; W/O. P. W. Williams.

MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Lt. G. B. Forrest, D.F.M.; Flt. Lt. J. Green, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. D. Close; Sgt. E. R. Kelsall; F/O. H. S. J. King; F/O. C. R. Parsons; W/O. J. Robertson; Flt. Lt. D. Welply; Sgt. C. Woodhead.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. Dawson; L.A/C. V. R. Edwards; L.A/C. S. H. Lazarus; L.A/C. F. G. Ovenden.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Flt. Sgt. W. F. Pywell.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—A/C.1 R. F. Cole; L.A/C. S. T. Poile; Cpl. D. Townsend.

WOUNDED OR INJURED ON ACTIVE SERVICE.—W/O. R. Dunne; Flt. Sgt. D. H. MacIntyre.

DIED ON ACTIVE SERVICE.—A/C.2 R. R. C. Anderson; A/C.2 F. Barclay; L.A/C. W. P. S. Blayney; Air Comdre. W. E. G. Bryant, M.B.E.; Flt. Sgt. E. W. Campany; Air Vice-Marshal J. B. Cole-Hamilton, C.B., C.B.E.; A/C.2 J. Cronin; Flt. Sgt. R. Dearden; L.A/C. W. Drummond; A/C.2 C. Filson; L.A/C. D. G. Gatward; Sgt. M. J. Green; Flt. Lt. F. J. Gunstone; L.A/C. J. H. Hall; L.A/C. C. J. Hammon; Cpl. W. Hill; L.A/C. K. N. Hodgkinson; Act. Wing Cdr. J. H. C. Hunter; L.A/C. B. B. Jameson; Flt. Lt. S. L. Jones; L.A/C. A. K. Manabridge; L.A/C. G. Melton-Spiers; Flt. Lt. R. P. Monico; Act. Sqn. Ldr. W. H. Monson; Cpl. A. Park; L.A/C. A. J. Payne; Cpl. W. W. Powell; Act. Sqn. Ldr. G. H. Ramsay; L.A/C. T. C. Raynes; Cpl. H. Robertson; L.A/C. W. K. Roughley; L.A/C. A. H. Schofield; L.A/C. W. Seaber; A/C.1 F. C. Thornton; Flt. Lt. A. J. Tucker; A/C.1 N. L. Tyson; Cpl. M. J. W. Upton; L.A/C. H. J. Woodgate.

## *Women's Auxiliary Air Force*

DIED ON ACTIVE SERVICE.—Cpl. E. B. Anderson; Cpl. C. Leitch; Flt./O. E. M. Sex.

## *Royal Australian Air Force*

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. C. G. Steele.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. J. W. Alcorn; P/O. M. H. Bell; Flt. Sgt. P. W. Benson; P/O. R. W. Crane; Flt. Sgt. K. C. Donald; P/O. L. E. Faithorn; W/O. N. F. Gelder; F/O. E. P. J. Gray; Flt. Sgt. M. W. Harrison; F/O. A. K. Hornibrook; Flt. Sgt. T. G. Jamieson; Flt. Sgt. R. H. McLean; Flt. Sgt. R. Parker; Flt. Sgt. V. J. Scheldt; Flt. Sgt. N. A. Taylor.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Flt. Sgt. H. J. Porter.

KILLED ON ACTIVE SERVICE.—W/O. J. P. Shanahan.

DIED ON ACTIVE SERVICE.—Sgt. R. S. McLeod; Sgt. E. South.

## *Royal Canadian Air Force*

KILLED IN ACTION.—F/O. J. L. McBride.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. F. McIntyre.

MISSING.—Sgt. R. H. Lacey; F/O. R. H. McLeod.

KILLED ON ACTIVE SERVICE.—W/O. J. M. Barker; F/O. S. D. Woodman.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. J. L. Underwood.

DIED ON ACTIVE SERVICE.—L.A/C. E. G. Dohoo; A/C.1 D. G. Farrar; L.A/C. L. M. Soubliere; Flt. Lt. W. E. Thomas.

## *Royal New Zealand Air Force*

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. A. E. Dryden.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. R. Barrett; Flt. Sgt. W. J. V. Boyd; Act. Flt. Lt. G. Brown; F/O. R. W. Brown; F/O. F. M. Clarke; Flt. Sgt. A. A. Fergusson; Flt. Sgt. J. Fitzgerald; Act. F/O. W. O. Hadley; P/O. M. C. Hollard; P/O. K. McI. Mackay; F/O. G. E. S. McNaughton; F/O. A. A. Matheson, D.F.M.; F/O. L. W. Neale; Flt. Sgt. W. G. Norton; P/O. E. G. Robinson; Flt. Sgt. J. D. Syverston; Act. Flt. Lt. C. J. Taylor; W/O. N. J. Trewavas; Act. F/O. D. G. Twidle; Flt. Sgt. W. D. Watson; P/O. W. A. Watt; P/O. R. B. Hemmings.

MISSING.—W/O. C. W. McCarthy.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—W/O. A. D. Grant.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Lt. A. H. Ching.

**IN BERLIN:** (Top) One of No. 33 Fighter Squadron's Hawker Tempests in peacetime silver finish. The squadron badge in the centre is a reminder that the hart's head was incorporated in the badge when the squadron was the first to be equipped with Hawker Harts in 1930. (Bottom) Flt. Lt. G. Mann (left) and Sqn. Ldr. A. W. Bowers, D.F.C. (right), who is C.O. of No. 33 Sqn. with Air Commodore H. W. Mermagen, C.B.E., A.F.C., A.O.C. British Air Command, Berlin. No. 33 Sqn. has now been replaced in Berlin by No. 56 Sqn.

*THE INDUSTRY*

# Bristol Light Engineering Division

## *Variety of Products : Plastics and Gun Turrets*

NOW growing out of the gun turret division of the Bristol Company is what can best be described as a firm within a firm. The Light Engineering Division has a separate board of directors, of which Mr. George White is chairman, Mr. Masterton looks after finance, and Major G. H. Abel is the general manager. Major Abel is now assisted by Wing Cdr. G. A. W. Garland, A.F.C., who was, until recently, a test pilot at Boscombe Down. He was among a select few who flew the D.H. Vampire and Hornet in their early service trials.

Major G. H. Abel.

The new division originated from the need of a central control of turret design and construction. This need gradually became more acute as Bristol turret design advanced from their original retracting cupola type on the early Blenheims to the complicated twin 20 mm cannon B17 turret now in production for the Avro Lincoln. It is interesting to note that this costly and intricate B17 turret was ordered "from the drawing board." Research and design had to proceed side by side. One test turret had 15,000 rounds fired from its guns, which is about 10 times the average life of any turret in the Service. In the production of cupolas for their gun turrets, the Bristol Company have accumulated considerable experience in the fabrication of plastics. This experience is now being turned to account in producing a variety of plastic mouldings and structures. These vary from cigarette boxes to welders' face shields and hundreds of thousands of bits and pieces are manufactured for the Bristol prefabricated houses.

Using plastic material, some most accurate jigs are being made for gas turbine blades and for complicated twists and bends on pipes in aircraft engine installations.

In the machine shop certain of the components for the new Bristol car are also manufactured and altogether there is a variety of output which is quite surprising in its scope. Gun turrets still form the major portion of the output, but there is a large potential already converted to commercial and industrial purposes.

### GOODRICH MANAGER

JOHN A. FISHER has been appointed district manager in Montreal for the industrial products division of the B. F. Goodrich Rubber Company of Canada. For three years he was on loan to the British Ministry of Aircraft Production as a constructor of aircraft factories in the United Kingdom.

### RADIO RECEPTION

DELEGATES from 12 European countries, including Russia, who were in this country at the invitation of the Ministry of Civil Aviation for talks on radio and radar aids, visited the New Southgate works of Standard Telephones and Cables, Ltd. The visitors showed particular interest in an ultra-short wave telephone set now in course of development and also in a new ground radio direction finder.

### SHORT STORY

SHORT BROS. have published the first issue of a house journal under the heading "Short Story." There is a glowing tribute to Oswald Short by J. Lankester Parker, who was for many years the firm's chief test pilot and is now on the board. He tells the story from when he first went to the company in 1916. There is also a description of Shorts' first factory under a railway arch in Battersea.

Application for copies may be made to the company at Rochester, Kent.

### SKEFKO SOUVENIR

UNDER the title "A Factory Went to War," the Skefko Ball Bearing Co., Ltd., have produced for their workpeople a very attractive souvenir of the firm's activities during the war years. It starts with a quotation from Winston Churchill's famous "This was their finest hour" speech and contains a considerable appreciation of the part played by bearings in the air war.

### BLACKBURN'S MOVE

AFTER many years' tenancy, Blackburn Aircraft, Ltd., are moving their London office from Norfolk Street to 11, Upper Grosvenor Street, W.1 (Grosvenor 3813), on March 21st.

### ATOMIC INSIGHT

NAVAL type (F-56) Fairchild cameras, some with 40in telephoto lenses, will be used to photograph the forthcoming atom bomb tests in the Pacific. The aircraft carrying these cameras will be radio controlled and the cameras will also be controlled in the same manner from a surface vessel. Special coverings for the lenses, operated by photo-electric cells, will be removed an instant after the flash.

### WELLWORTHY TRAVELLERS

MESSRS. C. KNIGHT and Mr. A. R. Martin, of Wellworthy Piston Rings engineering staff, have recently returned after a three months' visit to the United States.

Whilst in America they visited factories in all parts of the country and brought back with them valuable information regarding immediate and future developments in American piston and piston ring design and production.

For a number of years it has been the policy of Messrs. Wellworthy Piston Rings, Ltd., to collaborate with American manufacturers with beneficial results.

During the war period the Wellworthy organization was called upon to supply technical data and advice to American piston ring manufacturers making rings for high-duty aero engines.

### D.H.s IN SCANDINAVIA

THE de Havilland company have established a branch office for the Scandinavian countries. Mr. Sven Blomberg, who has looked after de Havilland interests in that area for many years, has been appointed general manager for Sweden, Norway and Denmark. His head office will be in Stockholm (Linnegatan 8). Mr. Blomberg has been engaged on the design and production sides of the aircraft industry for 24 years. He was actively concerned in the inauguration of the national Swedish aircraft factory, Svenska Aeroplan A.B., at Linköping.

### ROLLS-ROYCE APPOINTMENT

MR. W. G. T. GILL has been appointed to the Board of Rolls-Royce, Limited, as Commercial and Financial Director.

His appointment is deserved after his work during the arduous war years as chief accountant of the Rolls-Royce factory at Glasgow, which at one period achieved the astonishing output of over 1,000 new and repaired aircraft engines per month.

Mr. W. G. T. Gill.

He joined Rolls-Royce in 1939 at Glasgow, and in 1942 was appointed chief accountant of Rolls-Royce, Ltd., at Derby, and commercial manager in November, 1945.

### P.R.O. FOR AIRSPEEDS

MR. P. L. HANSON-LESTER has been appointed publicity, advertising and public relations representative of Airspeed Limited at Portsmouth and Christchurch.

In the R.A.F. he served both as an operational pilot and an instructor for five and a half years. Bailing out of a burning P.R.U. Spitfire near Malta, he qualified for membership of the Caterpillar and Goldfish Clubs.

On "D" Day he was appointed personal assistant to Air Vice-Marshal F. L. Hopps, C.B., C.B.E., A.F.C.

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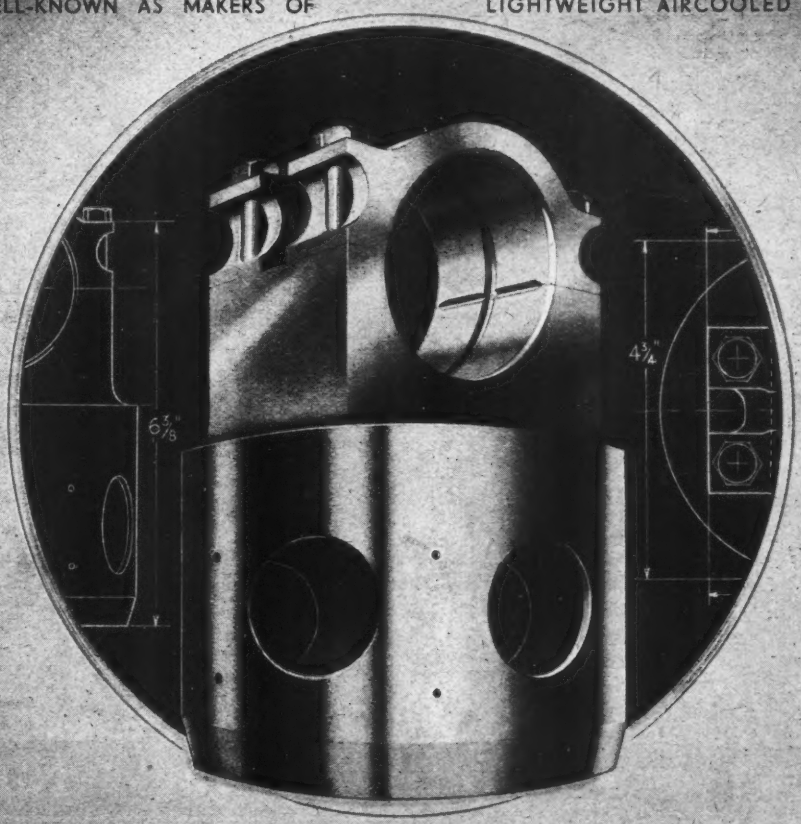


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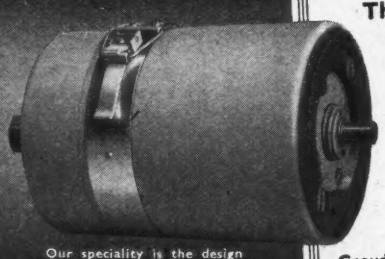

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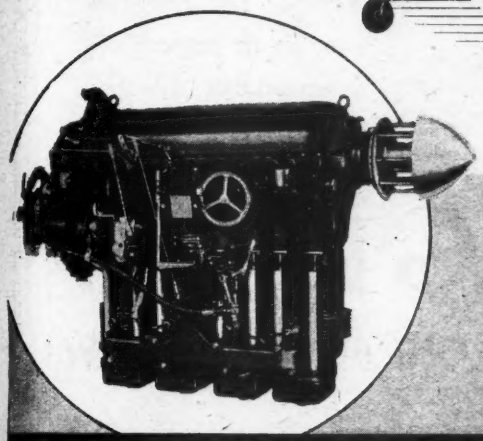

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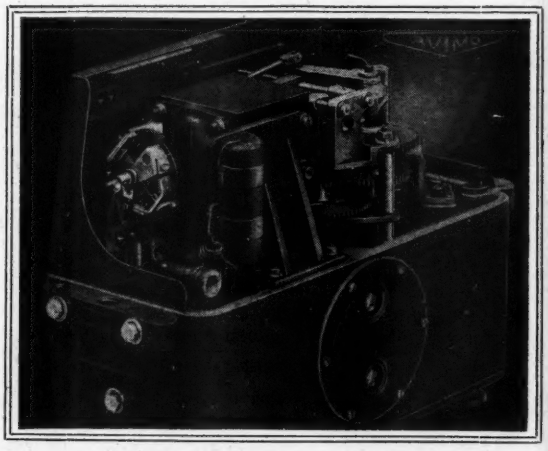

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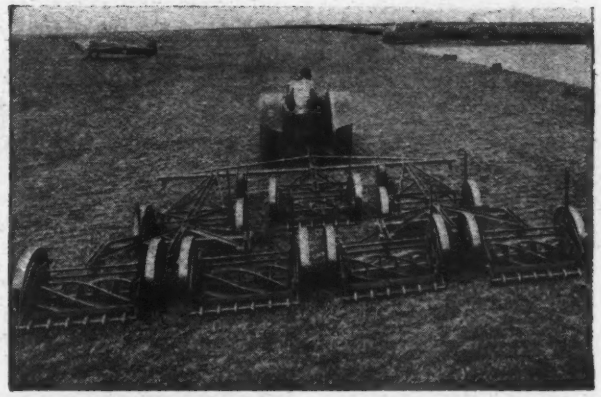

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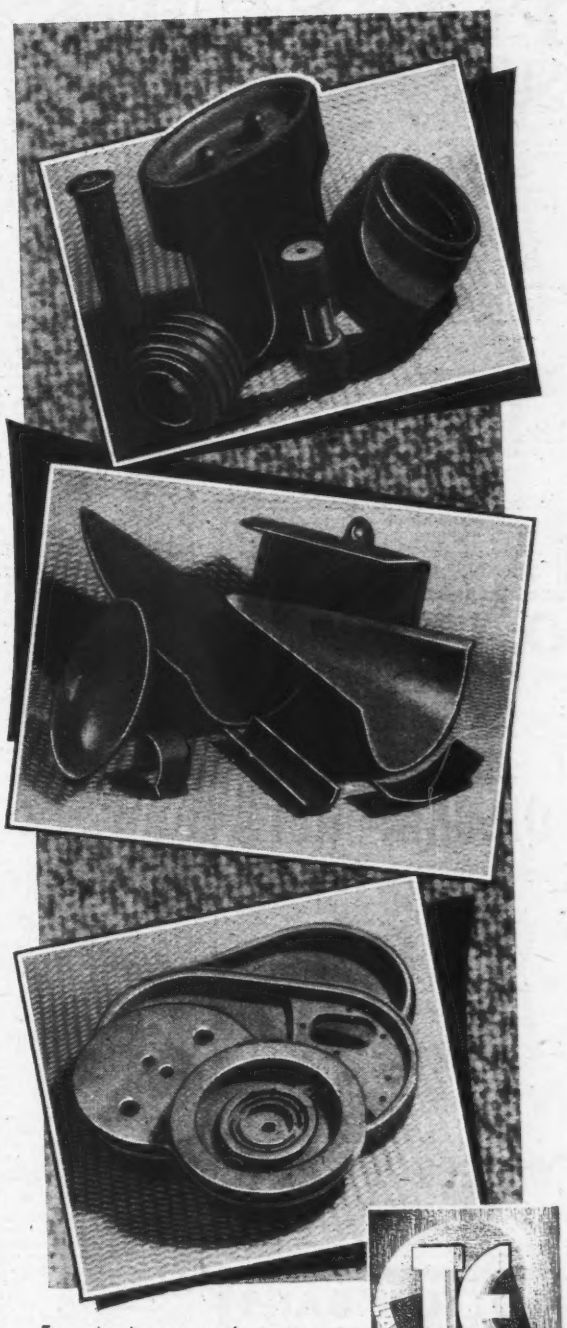

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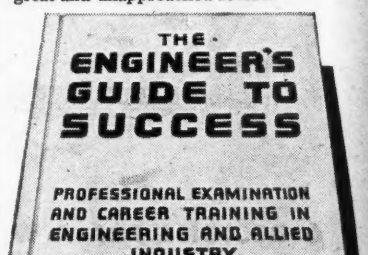


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APPLICATIONS are invited, from University graduates in engineering or science with research experience, for positions as research engineers and applied mathematicians in the aerodynamic, hydrodynamic, engine, structures and instrument laboratories and flight research establishment of the National Research Laboratories, Ottawa, Canada. Initial salaries range from $2,820 to $4,400

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### PATENTS

THE proprietor of British Patent No. 517775, entitled "Aircraft Construction," offers same for license or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Ehlert, Stern & Carlberg, Chicago, 4, Illinois, U.S.A. [6666


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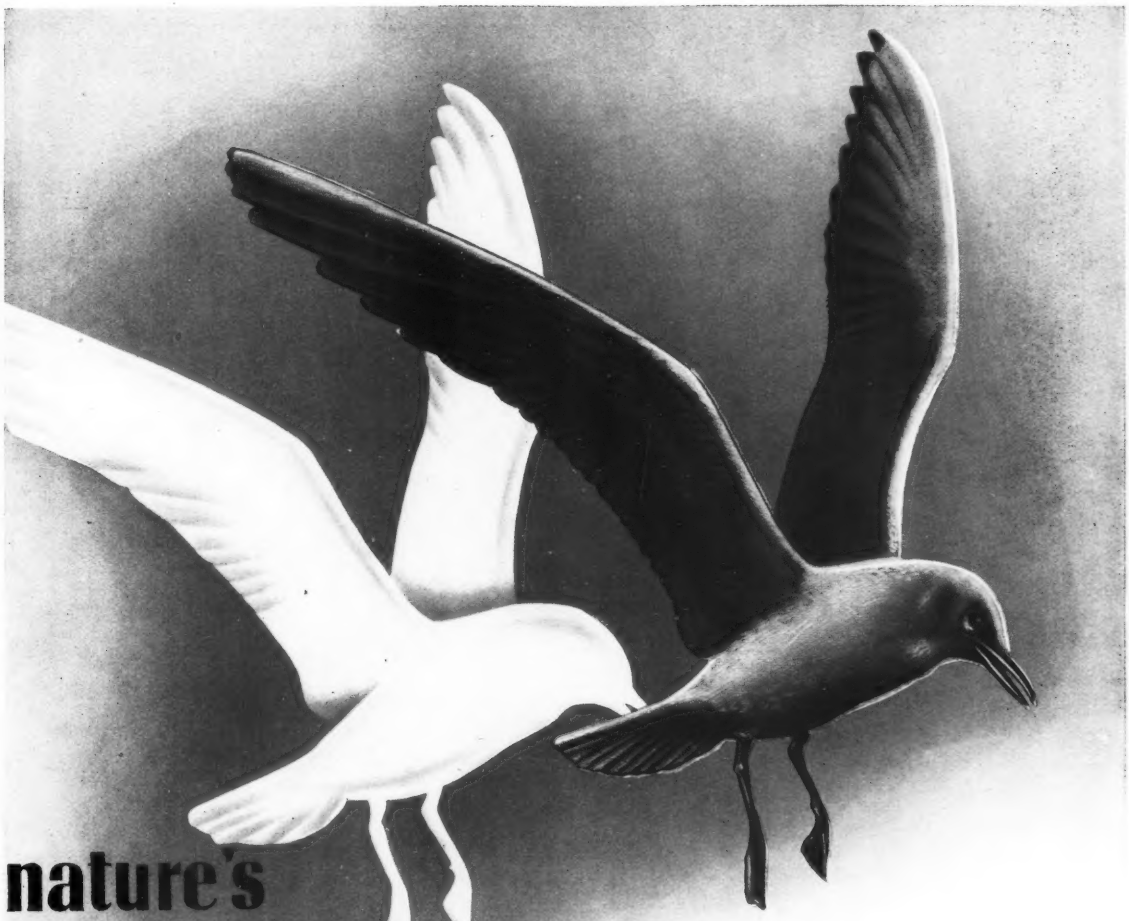

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